

SOUTHWEST FISHERIES SCIENCE CENTER

NATIONAL MARINE FISHERIES SERVICE

SOUTHWEST FISHERIES SCIENCE CENTER

P.O. BOX 271

LA JOLLA, CA 92037

JULY 1994

LIBRARY

AUG - 8 1994

National Marine Fisheries Service
2570 Dole Street
Honolulu, Hawaii

SUMMARY OF THE 1993 U.S. NORTH AND SOUTH PACIFIC ALBACORE TROLL FISHERIES

By

John Childers and Forrest R. Miller

ADMINISTRATIVE REPORT LJ-94-18

This Administrative Report is issued as an informal document to ensure prompt dissemination of preliminary results, interim reports and special studies. We recommend that it not be abstracted or cited.

SUMMARY OF THE 1993 U.S. NORTH AND SOUTH PACIFIC ALBACORE TROLL FISHERIES

John Childers
Southwest Fisheries Science Center
National Marine Fisheries Service, NOAA
La Jolla, CA 92038

and

Forrest R. Miller
Inter-American Tropical Tuna Commission
La Jolla, CA 92038

JULY 1994



Digitized by the Internet Archive
in 2025

CONTENTS

	Page
INTRODUCTION	1
CATCH/EFFORT SAMPLING COVERAGE	2
LENGTH-FREQUENCY SAMPLING COVERAGE	2
TOTAL CATCH AND EFFORT	3
CATCH RATES	4
LENGTH-FREQUENCIES	5
SEA SURFACE TEMPERATURES AND CATCH LOCATIONS	6
SUMMARY	7
THE 1994 U.S. NORTH PACIFIC ALBACORE SEASON	8
THE 1993-94 U.S. SOUTH PACIFIC ALBACORE SEASON	8
ACKNOWLEDGEMENTS	8
LITERATURE CITED	9

LIST OF TABLES

Table	Page
1. Landings of north Pacific albacore in metric tons by fisheries, 1952-1993	11
2. Landings of south Pacific albacore in metric tons by fisheries, 1952-1993	12
3. Sampling results of 1992 and 1993 U.S. North Pacific albacore troll fisheries ..	13
4. Sampling results of the 1991-92 and 1992-93 U.S. south Pacific albacore troll fisheries	13

LIST OF FIGURES

Figure	Page
1a. Sampled U.S. north Pacific albacore catches for May, 1993	15
1b. Sampled U.S. north Pacific albacore catches for June, 1993	16
1c. Sampled U.S. north Pacific albacore catches for July, 1993	17
1d. Sampled U.S. north Pacific albacore catches for August, 1993	18
1e. Sampled U.S. north Pacific albacore catches for September, 1993	19
1f. Sampled U.S. north Pacific albacore catches for October, 1993	20
1g. Sampled U.S. north Pacific albacore catches for November, 1993	21
1h. Sampled U.S. north Pacific albacore catches for the 1993 season	22
2a. Sampled U.S. south Pacific albacore catches for December, 1992	23
2b. Sampled U.S. south Pacific albacore catches for January, 1993	24
2c. Sampled U.S. south Pacific albacore catches for February, 1993	25
2d. Sampled U.S. south Pacific albacore catches for March, 1993	26
2e. Sampled U.S. south Pacific albacore catches for April, 1993	27
2f. Sampled U.S. south Pacific albacore catches for the 1992-93 season	28
3a. U.S. north Pacific albacore catch rates for May, 1993	29
3b. U.S. north Pacific albacore catch rates for June, 1993	30
3c. U.S. north Pacific albacore catch rates for July, 1993	31
3d. U.S. north Pacific albacore catch rates for August, 1993	32
3e. U.S. north Pacific albacore catch rates for September, 1993	33
3f. U.S. north Pacific albacore catch rates for October, 1993	34

Figure	Page
3g. U.S. north Pacific albacore catch rates for November, 1993	35
3h. U.S. north Pacific albacore catch rates for the 1993 season	36
4a. U.S. south Pacific albacore catch rates for December, 1992	37
4b. U.S. south Pacific albacore catch rates for January, 1993	38
4c. U.S. south Pacific albacore catch rates for February, 1993	39
4d. U.S. south Pacific albacore catch rates for March, 1993	40
4e. U.S. south Pacific albacore catch rates for April, 1993	41
4f. U.S. south Pacific albacore catch rates for the 1992-93 season	42
5. Length-frequencies of albacore sampled from the 1993 U.S. north Pacific troll fishery	43
6. Size distribution of albacore sampled from the 1993 U.S. north Pacific troll fishery summarized by $5 \times 10^\circ$ quadrangles	44
7. Length-frequencies of sampled albacore from the 1992-93 U.S. south Pacific troll fishery	46
8. Size distribution of albacore sampled from the 1992-93 U.S. south Pacific troll fishery summarized by $5 \times 10^\circ$ quadrangles	47
9a. Average SST isotherms and general catch area of U.S. north Pacific albacore troll fleet for May, 1993	48
9b. Average SST isotherms and general catch area of U.S. north Pacific albacore troll fleet for June, 1993	49
9c. Average SST isotherms and general catch area of U.S. north Pacific albacore troll fleet for July, 1993	50
9d. Average SST isotherms and general catch area of U.S. north Pacific albacore troll fleet for August, 1993	51
9e. Average SST isotherms and general catch area of U.S. north Pacific albacore troll fleet for September, 1993	52

Figure	Page
9f. Average SST isotherms and general catch area of U.S. north Pacific albacore troll fleet for October, 1993	53
9g. Average SST isotherms and general catch area of U.S. north Pacific albacore troll fleet for November, 1993	54

SUMMARY OF THE 1993 U.S. NORTH AND SOUTH PACIFIC ALBACORE TROLL FISHERIES

John Childers
Southwest Fisheries Science Center
National Marine Fisheries Service, NOAA
La Jolla, CA 92038

and

Forrest R. Miller
Inter-American Tropical Tuna Commission
La Jolla, CA 92038

INTRODUCTION

The U.S. north Pacific troll fishery for albacore tuna (*Thunnus alalunga*) catches 15% to 25% of the annual, total landings of north Pacific albacore by all fisheries (Table 1). Although annual U.S. albacore landings have declined in recent years, larger troll vessels have entered the fishery, expanding the traditional north Pacific albacore fishing grounds westward from the coasts of California, Oregon, and Washington, toward the international dateline. In recent years, the north Pacific albacore season has begun in May, northwest of Hawaii between latitudes 30°N and 40°N. U.S. troll vessels move eastward in their search for schools of albacore as the season progresses. Smaller troll vessels and vessels using live bait usually begin fishing for albacore in mid or late July in the coastal areas off California, Oregon, and Washington. Coastal upwelling develops off the coast of California during the summer months (July through October) creating productive albacore fishing grounds where the enriched, cold, coastal water meets the warmer oceanic water. The north Pacific albacore season usually ends in October or November.

Exploratory troll fishing in areas east of New Zealand in 1986 resulted in the development of the U.S. south Pacific albacore troll fishery. This fishery has historically taken less than 10% of the total annual south Pacific albacore catch by all fisheries (Table 2). Many large, long-range U.S. troll vessels leave the U.S. west coast after the end of the north Pacific season for the fishing grounds of the southern hemisphere where albacore fishing takes place during the austral summer months (December through April). The southern fishing grounds for the troll fishery extend from the west coast of New Zealand to approximately 110°W between 30°S and 45°S. Most U.S. troll vessels leave the southern hemisphere after the southern season and run to Hawaii or the U.S. west coast to begin the north Pacific fishing season again.

The National Marine Fisheries Service (NMFS) Southwest Fisheries Science Center (SWFSC) in cooperation with American Fishermen's Research Foundation (AFRF), Western Fishboat Owners Association (WFOA), and state fisheries agencies, maintains a program for sampling catch/effort and length-frequency information from the U.S. albacore fisheries in both hemispheres. Catch/effort data are obtained from completed copies of the "U.S. Pacific

Albacore Logbook", that are voluntarily submitted by fishermen, or from voluntary interviews of fishermen conducted by port samplers. Over four hundred logbooks were distributed to albacore fishermen prior to, and during the 1993 north Pacific albacore season and the 1992-93 south Pacific albacore season by the SWFSC's La Jolla and Honolulu laboratories, the Southwest Regional (SWR) Office in American Samoa, WFOA, and the state fisheries agencies of California, Oregon, and Washington. Four biologists accompanied four fishing vessels during the 1993 north Pacific season to collect catch/effort, length-frequency, and biological information. Catch/effort and length-frequency information from the 1992-93 U.S. south Pacific albacore fishery were collected by the SWR office in American Samoa.

Sampled information for the U.S. albacore fisheries was, in past years, separated according to gear type (live bait, troll, gill net) where possible. The recent decline in live bait and drift gill net fishing for north Pacific albacore by U.S. vessels, has resulted in the absence or near-absence of sampling information for these gear types. Neither live bait nor drift gill nets are used by U.S. vessels fishing for albacore in the south Pacific fishery. This report summarizes information collected from the 1993 north Pacific albacore season and the 1992-93 south Pacific albacore season for troll gear only. Data from the 1992 north Pacific season, 1991-92 south Pacific season, and landings of albacore by other nations (where available) are included for comparison.

CATCH/EFFORT SAMPLING COVERAGE

Catch/effort information for the 1993 north Pacific albacore fishing season (from logbooks or interviews) was collected from 169 trips of the 1,887 trips completed during the season. These 169 sampled vessel trips landed a total of 1,119 t. Catch/effort sampling coverage rates were calculated as the ratio of sampled landing tonnages to total landing tonnages. The 1993 north Pacific catch/effort sampling coverage rate is 18%, significantly less than the 1992 season's catch/effort sampling coverage rate of 38% (Table 3). In past years, interviews of fishermen (conducted by port samplers), were a significant source of catch/effort information. Very few of these interviews were conducted during the 1993 north Pacific season due to reductions in funding for albacore sampling programs. The reduced number of interviews resulted in the significant decrease in catch/effort sampling coverage.

Catch/effort information for the 1992-93 south Pacific season was collected from 10 trips of the 62 trips completed by U.S. troll vessels. These ten sampled vessel trips landed 172 t. The catch/effort sampling coverage rate for the 1992-93 south Pacific season is 17% compared with a catch/effort sampling coverage rate of 60% for the 1991-92 season (Table 4). The reduced catch/effort sampling coverage rate in the south Pacific fishery was a result of the frustration over poor catches by many U.S. albacore fishermen who did not complete or submit logbooks for the 1992-93 south Pacific albacore season.

LENGTH-FREQUENCY SAMPLING COVERAGE

All albacore sampled for fork lengths during the 1993 U.S. north Pacific season were caught with troll gear. Length-frequency samples were collected by port samplers and by SWFSC biologists onboard U.S. troll vessels in past years. Port sampling of length-frequency

data was suspended for the 1993 north Pacific season due to lack of available funding. Approximately 10,885 albacore were sampled for fork lengths by four biologists accompanying four vessel trips during the 1993 north Pacific albacore season, compared with 41,123 albacore sampled (by port samplers and biologists at sea) during the 1992 season. The length-frequency samples collected during the 1993 north Pacific season represent all months of the 1993 north Pacific season and a high percentage of the areas fished during the season by U.S. troll vessels.

Length-frequency sampling coverage rates were calculated as the ratio of the number of fish sampled to the total number of fish landed for the season (estimated as total landings divided by average weight). The length-frequency sampling coverage for the 1993 north Pacific season is 1.19% compared with 5.15% length-frequency sampling coverage in 1992 (Table 3). The elimination of length-frequency sampling by port samplers caused the large decrease in length-frequency sampling coverage.

Sampling of south Pacific albacore, caught by U.S. troll vessels, for fork lengths was conducted by port samplers from the NMFS, SWR American Samoa office during the 1992-93 season. Port samplers in American Samoa measured 1,720 albacore, resulting in a length-frequency sampling coverage rate of 0.99% for the 1992-93 south Pacific albacore season, compared with 5,009 albacore measured and a length-frequency coverage rate of 1.26% for the 1991-92 season (Table 4). The collection of length-frequency data from U.S. south Pacific albacore catches was hampered by the transshipment of catches and fewer direct landings that were available to be sampled for length-frequency information.

TOTAL CATCH AND EFFORT

Approximately 650 U.S. troll vessels participated in the 1993 north Pacific albacore fishery (estimated from state landings reports and catch/effort sampling ratio). These vessels fished an estimated 24,470 standardized days (fishing effort was calculated as total landings divided by average stratified catch rate divided by average weight) and landed a total of 6,254 t of albacore at ports in Washington, Oregon, and California. The total landings from the 1993 north Pacific albacore season increased 37% from 4,572 t landed in 1992 and total effort by the U.S. troll fleet increased 56% from 15,666 days fished during the 1992 north Pacific season (Table 3). The 1993 season represented the third consecutive season of increased landings by the north Pacific albacore fishery. The cessation of high seas drift gill net fishing for albacore in the north Pacific and the diminishing effects of the most recent El Niño event may have contributed to this recent upward trend in annual albacore landings by the U.S. troll fleet.

The 1993 north Pacific albacore season began in May north of Midway island (Figure 1a). Incidental catches of skipjack (*Katsuwonus pelamis*), mahi mahi (*Coryphaena hippurus*), and billfish were occasionally made by U.S. troll vessels en route to the fishing grounds. The sampled fleet progressed eastward throughout June and July, between 34°N and 43°N (Figures 1b and 1c). The highest catches sampled during the 1993 north Pacific albacore season were in August and September in three distinct areas: 40 nm to 90 nm off the coast of Oregon, near 150°W (about 1000 nm off Oregon), and east of the international dateline near 43°N. Sampled catches diminished in October and November, when the north Pacific season ended, and were

localized off the Oregon coast (Figures 1f and 1g). The distribution of sampled albacore catches for the 1993 north Pacific season is displayed by 1° quadrangles in Figure 1h.

Information on amounts of north Pacific albacore landed by foreign nations in 1993 was extremely limited or not yet available. The preliminary estimate of the total amount of albacore landed by the Japanese pole and line fleet was 12,460 t, slightly less than the 17,779 t landed by the Japanese pole and line fleet in 1992, yet significantly more than the annual amounts landed between 1988 and 1991 (Table 1).

Forty-seven U.S. troll vessels participated in the 1992-93 south Pacific albacore fishery. These vessels fished an estimated 3,846 standardized days, a decrease of 18% from 4,679 days fished by 55 vessels in the 1991-92 season (Table 4). The total landings for the 1992-93 south Pacific season decreased to 1,028 t, 66% less than the 3,016 t landed in the 1991-92 season.

The 1992-93 south Pacific albacore season began in December, 1992 east of New Zealand's north island. Sampled catch areas in December, 1992 extended east to 145°W (Figure 2a). Sampled catches increased in January and February, 1993 between 150°W and 160°W (Figures 2b and 2c). Sampled catches decreased in March and April, when the 1992-93 south Pacific season ended (Figures 2d and 2e). The distribution of sampled albacore catches from the 1992-93 south Pacific season is displayed by 5° quadrangles in Figure 2f. Sparse amounts of bait fish were reported (in sampled logbooks) in the unusually warm surface waters during the 1992-93 south Pacific season, presumably resulting in fewer albacore being available to the troll gear. The unusually warm surface waters may have been attributable to the strong El Niño phenomena in the area.

Foreign landings of albacore from the south Pacific (where available) are shown in Table 2. Albacore landings from foreign fleets fishing in the southern hemisphere were not available for the 1993 season, hence it is unknown if the strong El Niño had any effect on the catches of albacore in other fisheries.

CATCH RATES

Stratified catch rates (expressed as numbers of fish caught per day of fishing) for U.S. troll vessels may be an indication of relative abundance of albacore. The individual strata, for which catch rates were calculated, were defined as 10-day, 1°-square quadrangles in which there was at least one day of fishing effort (Kleiber and Perrin, 1991). Stratified catch rates for each month of the north Pacific season were obtained by averaging the catch rates calculated for all strata in the respective month. The general equation for the calculation of stratified catch rates is:

$$\text{Average stratified catch rate} = 1/n \sum (\sum C_i / \sum E_i)$$

Where C was the total sampled catch in the *i*th strata, E was the total sampled effort in the *i*th strata, and *n* was the total number of strata.

The average stratified catch rate for the 1993 north Pacific season is 38 fish per day, compared with the 1992 season's average stratified catch rate of 54 fish per day. The stratified

catch rate for the 1993 season declined (despite an increase in total landings) due to an increase in effort (Table 3).

Stratified catch rates, summarized by month for the 1993 north Pacific season, displayed roughly the same distribution pattern as sampled catches. Sampled vessels that fished north of Midway island in May had high catch rates near 34°N (Figure 3a). The areas near 40°N, 150°W produced high catch rates from June through August as vessels moved progressively eastward during the season (Figures 3b through 3d). Good catch rates in August were also evident southeast of Graham island, Canada, and 40 nm to 85 nm off the Oregon coast (Figure 3d). Catch rates in September improved off the Oregon coast as sampled vessels became more localized near the west coast. High catch rates were enjoyed by one sampled vessel that returned to areas west of the international dateline and fished near 43°N in August (Figure 3e). Catch rates in October and November followed the same declining trend as sampled catches for those months (Figures 3f and 3g). Catch rates summarized for the 1993 north Pacific season, indicated that the most successful fishing areas were along 43°N near the international dateline, just west of 150°W, and off the California and Oregon coasts. Moderate catch rates were also evident southeast of Graham island, Canada and north of the Hawaiian islands near 37°N (Figure 3h).

The average stratified catch rate for the 1992-93 south Pacific season is 45 fish per day compared with a catch rate of 85 fish per day for the 1991-92 south Pacific season (Table 4). The 1992-93 stratified catch rate was the lowest catch rate since the inception of the fishery in 1986.

Unlike stratified catch rates in the north Pacific fishery, monthly-summarized catch rates for the 1992-93 south Pacific fishery did not always display similar distribution patterns as the corresponding distributions of sampled catches. Catch rates, summarized by month, exceeded 100 fish per day only in the month of February (Figure 4c). Catch rates summarized for the 1992-93 south Pacific season indicated that successful fishing was limited to a small area extending from 35°S to 45°S, and from 150°W to 160°W (Figure 4f). This area was the only area where average stratified catch rates for the season exceeded 50 fish per day.

LENGTH-FREQUENCIES

A total of 10,885 north Pacific albacore were sampled for fork length by four biologists aboard four U.S. troll vessels during the 1993 season. The average fork length of sampled albacore from the 1993 north Pacific season is 69 cm (15.0 lbs) compared with an average fork length of 64 cm (12.0 lbs) for the 1992 season (length-weight conversions from Clemens, 1961). Fork lengths of sampled north Pacific albacore ranged from 43 cm to 92 cm with two distinct length-frequency modes apparent (Figure 5). A primary mode is centered at 74 cm fork length and a smaller, secondary mode is centered at 64 cm fork length. These two fork lengths correspond, approximately, to 4 year-old fish and 3 year-old fish, respectively (Length-age conversions from Clemens, 1961, modified by Bartoo). Length-frequency sample data from the 1993 north Pacific season were summarized by 5° x 10° quadrangles (Figure 6). Three modes are evident in the histograms of samples collected from the 1993 U.S. north

Pacific albacore fishery. Larger fish are more prevalent in the histograms of sampled albacore from higher latitudes east of 140°W.

Albacore caught by U.S. troll vessels during the 1992-93 south Pacific season were sampled for fork lengths by port samplers in American Samoa. Only 1,720 albacore were sampled from eight U.S. troll vessels due to the small number of direct landings. The average fork length of sampled south Pacific albacore from the 1992-93 season is 63 cm (13.1 lbs) compared with an average fork length of 69 cm (16.7 lbs) for albacore sampled during the 1991-92 south Pacific season (length-weight conversions from Nakamura and Uchiyama, 1966). Sampled albacore from the 1992-93 south Pacific season ranged from 45 cm to 100 cm, with a large, distinct mode centered at 60 cm fork length and a minor, less-defined mode centered at 69 cm fork length. These fork lengths correspond, approximately, to 3 year-old fish and 4 year-old fish, respectively (length-age conversion from Labelle, 1993).

Catch locations are available for 400 of the 1,720 albacore sampled for fork lengths from the 1992-93 south Pacific season. These 400 albacore were caught within two 5x10° quadrangles from 30°S to 40°S and 150°W to 160°W (Figure 8). Albacore larger than 85 cm fork length were more prevalent in samples from lower latitudes.

SEA SURFACE TEMPERATURES AND CATCH LOCATIONS

Sea surface temperatures (SST's) recorded from commercial transport ships, fishing vessels and research vessels, were compiled into monthly means and analyzed by computer. Contours of SST's (isotherms) were drawn with 1° latitude-longitude resolution on charts by computer. Analyses of the monthly mean SST's (Figures 9a through 9g) show the distribution of isotherms and the location of SST frontal zones (areas of horizontally closely-packed isotherms). General albacore catch areas for the 1993 north Pacific season are shaded in the Figures to display the correlation between areas of fishing effort, SST fronts, and SST distribution patterns.

The first albacore catches in May, 1993 were made in the central north Pacific, along the subarctic ocean front that was located south of the 15°C (59°F) isotherm near 35°N between 165°W and 175°E (Figure 9a). In this mid-Pacific area, SST's were 1°C to 2°C (1.8°F to 3.6°F) below normal. The largest concentration of sampled albacore catches in June occurred between the 15°C and 18°C (59°F and 64.4°F) isotherms, west of 155° W. In this region, SST's were 1°C to 3°C (1.8°F to 5.4°F) below normal. In July, 1993, the best sampled catches were again between the 15°C and the 18°C (59°F and 64.4°F) isotherms, but east of 155°W, where the subarctic front was predominantly north of 40°N. The best sampled catches at this time were concentrated where SST's were about 1°C (1.8°F) below normal. During this period, sampled fishing was concentrated in offshore areas and also inshore areas near Washington and Oregon where coastal upwelling was becoming evident as north-south frontal boundaries. During August and September, 1993, most of the sampled catch areas moved from the offshore area between 40°N and 45°N, toward the U.S. west coast at similar latitudes. The largest sampled catches during this time period, occurred in coastal, frontal areas where SST's were 1°C (1.8°F) below normal and the isotherms were closely packed near the 15°C (59°F) isotherm (Figure 9d). By September, 1993, sampled fishing activity in offshore areas was

markedly reduced. During the months of October and November, 1993, sampled catches were concentrated in the inshore areas from Vancouver island to Cape Blanco, proximate to the 15°C (59°F) isotherm (Figures 9f and 9g). In October, 1993 the SST frontal boundaries were most pronounced on the eastern side of the 15°C (59°F) isotherm from Washington to northern California. In this area, SST's were 1°C to 2°C (1.8°F to 3.6°F) below normal, due, in part, to the strong coastal upwelling during September and October, 1993. By November, 1993 the 15°C (59°F) isotherm had receded southward and more offshore. As a result, the SST frontal boundaries had weakened considerably, and sampled albacore catches decreased. Sea surface temperature data are not available for the albacore fishing grounds in the southern hemisphere.

SUMMARY

Catch/effort sampling coverage and length-frequency sampling coverage in the 1993 north Pacific albacore fishery declined to 18% and 1.19%, respectively. The reduced sampling coverage was due to the reduction of available resources for the collection of data. Approximately 650 U.S. troll vessels participated in the 1993 north Pacific albacore fishery, expended 24,470 standardized days of effort and landed a total of 6,254 t. Total annual landings for the 1993 north Pacific albacore fishery increased, but the average stratified catch rate for the 1993 north Pacific season declined to 38 fish per day. The 1993 north Pacific albacore fishery began in May, north of Midway island and ended in early November off the coast of Oregon. Areas of highest sampled catches were west of the international dateline near 43°N, near 150°W on the same latitude, and off the coast of Oregon. Fork lengths were measured from 10,885 north Pacific albacore during the 1993 season, resulting in an average length of 69 cm (15.0 lbs) and a range of 43 cm to 92 cm. Well-defined length-frequency modes are evident at 74 cm and 64 cm fork lengths of sampled U.S. north Pacific albacore. Areas of high sampled catches of U.S. north Pacific albacore were correlated with tightly-grouped SST isotherms. The majority of sampled albacore catches were between the 15°C and 18°C (59°F and 64.4°F) isotherms. The SST's in these areas were generally 1°C (1.8°F) to 3°C (5.4°F) below normal. High sampled catches also occurred near inshore frontal boundaries, created by coastal upwelling, near the 15°C (59°F) isotherm.

Catch/effort sampling coverage and length-frequency sampling coverage for the 1992-93 south Pacific albacore fishery declined to 17% and 0.99%, respectively. The reduced catch/effort sampling coverage was due to the lack of available data. The reduced length-frequency sampling coverage was due to the few direct landings available to be sampled. The 1992-93 south Pacific albacore fishery was composed of 47 U.S. troll vessels that expended 3,846 standardized days of effort and landed a record low 1,028 t of albacore. The average stratified catch rate for the 1992-93 south Pacific albacore fishery is 45 fish per day, the lowest level since the inception of the fishery. A total of 1,720 albacore were sampled for fork lengths during the 1992-93 south Pacific fishery and ranged from 45 cm to 100 cm, with an average length of 63 cm (13.1 lbs). A large length-frequency mode, centered at 60 cm fork length, and a minor mode, centered at 69 cm fork length, are evident in the length-frequencies of albacore sampled during the 1992-93 south Pacific albacore season. The 1992-93 south Pacific season began in December, 1992 and ended in April, 1993.

THE 1994 NORTH PACIFIC SEASON

Successful fishing has been reported by U.S. troll vessels that began the 1994 north Pacific albacore season in May, in areas near and east of the international dateline. Approximately 1000 albacore were tagged and released in these areas. Preliminary oceanographic observations indicate favorable conditions may develop in areas off southern California, bringing albacore within reach of local fishing vessels. The number of U.S. troll vessels which will participate in the 1994 north Pacific albacore season may increase if displaced salmon trollers join the U.S. albacore fleet. Fishing near the west coast is expected to continue to be productive along temperature gradients that develop when summer upwelling occurs along the coast from central California to Washington state.

THE 1993-94 SOUTH PACIFIC SEASON

Preliminary sampling from the 1993-94 south Pacific albacore season has shown a decline in landings from the 1992-93 season. Total annual landings from the south Pacific fishery may remain low until more vessels return to the southern fishing grounds. Catch rates improved, however, and the effects of the strong El Niño appeared to be subsiding. More albacore may become available to troll gear as surface water temperatures return to normal and the amounts of forage in these waters increase.

ACKNOWLEDGEMENTS

We thank the U.S. albacore fishermen whose active participation in the sampling program made this fisheries summary possible. We thank American Fisherman's Research Foundation and William Perkins of the Western Fishboat Owner's Association for their participation in and financial support of the sampling program. We also thank Rhonda Haynes of Oregon Department of Fish & Wildlife, Traci Bishop of California Department of Fish & Game, Farron Wallace of Washington Department of Fisheries, Russ Porter of Pacific Marine States Fisheries Commission, Gordon Yamasaki of the SWR office in Pago Pago, American Samoa, the SWFSC Honolulu laboratory and the port samplers for the collection of catch/effort, length-frequency and landings data and the distribution of Pacific Albacore Logbooks.

Karen Handschuh typed and formatted the manuscript. Roy Allen and Henry Orr (NMFS La Jolla Laboratory) produced the illustrations. Atilio Coan, Jr., Dr. Jerry Wetherall, Dr. Norman Bartoo, and Gary Sakagawa provided helpful directions, comments and critiques of the manuscript.

LITERATURE CITED

- Clemens, Harold B. 1961. The migration, age, and growth of Pacific albacore (*Thunnus germon*), 1951 - 1958. State of Calif., Dept. of Fish & Game, Fish Bull. No. 115. p. 97.
- Kleiber, P. and C. Perrin. 1991. Catch-per-effort and stock status in the U.S. north Pacific albacore fishery: reappraisal of both. U.S. Fish. Bull. 89:379-386.
- Labelle, M. 1993. Estimates of age and growth for south Pacific albacore. Fourth south Pacific albacore research workshop, Taipei, Republic of China, Nov. 1991. Working paper number 5, 17p.
- Nakamura, E.L. and J.H. Uchiyama. 1966. Length - weight relations of Pacific tunas. In T.A. Manar (ed.), Proceedings, Governors conference on central Pacific fisheries resources, State of Hawaii. pp. 197 - 201.

Table 1. Landings of North Pacific albacore in metric tons by fisheries, 1952-1993. Provisional estimates are given in parentheses. -- indicates data not available. (0) indicates less than 1 metric ton.

YEAR	JAPAN ¹					TAIWAN ⁴		KOREA ²		UNITED STATES ³					CANADA	MEXICO	GRAND TOTAL
	POLE & LINE	LONG LINE	GILL NET	PURSE SEINE	OTHER GEAR	LONG LINE	GILL NET	LONG LINE	GILL NET	BAIT BOAT	TROLL	SPORT	GILL NET	PURSE SEINE	OTHER GEAR	TROLL	
1952	41,786	26,687			237						23,843	1,373				71	93,997
1953	32,921	27,777		38	132						15,740	171				5	76,784
1954	28,069	20,958		23	38						12,246	147					61,481
1955	24,236	16,277		8	136						13,264	577					54,498
1956	42,810	14,341			57						18,751	482				17	76,458
1957	49,500	21,053		83	151						21,165	304				8	92,264
1958	22,175	18,432		8	124						14,855	48				74	55,716
1959	14,252	15,802			67						20,990	0			5	212	51,328
1960	25,156	17,369			76						20,100	557			4	5	63,267
1961	18,636	17,437			268					2,837	12,055	1,355			6	4	52,605
1962	8,729	15,764			191					1,085	19,752	1,681			8	1	47,264
1963	26,420	13,464			218					2,432	25,140	1,161			7	5	68,906
1964	23,858	15,458			319					3,411	18,388	824			4	3	62,419
1965	41,491	13,701			121	26				417	16,542	731			3	15	73,293
1966	22,830	25,050			585	261				1,600	15,333	588			9	44	66,421
1967	30,481	28,869			520	271				4,113	17,814	707			12	161	83,401
1968	16,597	23,961			1,109	635				4,906	20,434	951			10	1,028	69,961
1969	32,107	18,006			1,480	698				2,996	18,827	358			12	1,365	76,306
1970	24,376	15,372			794	634				4,416	21,032	822			9	354	69,008
1971	53,198	11,035			367	1,516				2,071	20,526	1,175			11	1,587	92,631
1972	60,762	12,649	1		646	1,759				3,750	23,600	637			8	3,558	109,079
1973	69,811	16,059	39		533	3,091				2,236	15,653	84			14	0	107,180
1974	73,576	13,053	224		959	128				4,777	20,178	94			9	1,207	114,809
1975	52,157	10,060	166		254	1,494		2,463		3,243	18,932	640			43	1	89,713
1976	85,336	15,896	1,070		285	1,251		859		2,700	15,905	713			27	36	125,439
1977	31,934	15,737	688		379	873		792		1,497	9,969	537			36	0	63,164
1978	59,877	13,061	4,029		2,097	284		228		950	16,613	810			69	23	99,157
1979	44,662	14,249	2,856		1,158	187		259	(0)	303	6,781	74			31	1	(71,207)
1980	46,743	14,743	2,986		1,209	318	--	597	(6)	382	7,556	168			24	31	(75,304)
1981	27,426	18,020	10,348		904	339	--	459	(16)	748	12,637	195			60	8	(71,612)
1982	29,615	16,762	12,511		732	559	--	387	(113)	425	6,609	257			84	7	(68,726)
1983	21,098	15,103	6,852		125	520	--	454	(233)	607	9,359	87			213	33	(55,259)
1984	26,015	15,111	8,988		518	471	--	136	(516)	1,030	9,304	1,427			138	113	(70,925)
1985	20,714	14,320	11,204		407	109	--	291	(576)	1,498	6,415	1,176			83	49	(58,433)
1986	16,096	12,945	7,813		650	--	--	241	(726)	432	4,708	196			106	3	(45,491)
1987	19,091	14,642	6,698		189	--	2,514	182	(817)	158	2,766	74			136	7	(48,588)
1988	6,216	13,904	9,074		177	38	7,389	109	(1,016)	598	4,212	64			318	15	(44,508)
1989	8,629	13,194	7,437		466	544	8,350	81	(1,023)	54	1,860	160			272	2	(44,797)
1990	8,532	15,928	6,064		253	287	16,701	20	(1,016)	115	2,603	24			71	181	(54,123)
1991	7,103	10,379	3,401		399	353	3,398	3	(852)	0	1,845	6			0	384	(30,931)
1992	17,779	(10,379)	(3,401)		(399)	300	7,866	43	(271)	0	4,572	(2)			0	408	(50,813)
1993	(12,462)	(10,379)	--		(399)	(300)	0	(43)	0	--	6,254	(25)			--	230	(32,253)

¹ Japanese pole & line landings include fish caught by research vessels. Longline landings for 1952-1960 exclude minor amounts taken by vessels under 20 tons; landings are estimated by multiplying annual number of fish caught by average weight statistics. Pole & line, longline, driftnet, purse seine and other gear data for 1952-1991 from Y. Uozumi, et. al., NPALB13/25, 1993. Pole & line and purse seine data for 1992, 1993 from Y. Warashina, et. al., NPALB13/7, 1993.

² Korean longline landings calculated from Y. Gong, NPALB13/28, 1993, using the ratio of landings, in numbers, from the north Pacific. Gillnet landings for 1979-1990 are calculated by multiplying the 1991 CPUE (# fish per pok) by effort (# poks) then multiplying by average weight (1991, 1992: 4.13 kg/fish).

³ U.S. troll boat landings for 1952-1960 include fish caught by bait boats. U.S. troll boat landings for 1984-1988 include gillnet landings. Other gear include landings from Hawaii (mostly longline). Other gear landings for 1979-1986 are raised from data with very low coverage rates.

⁴ Data provided by H. Liu, NPALB13/29, 1993.

Table 2. Landings of South Pacific albacore in metric tons by fisheries, 1952-1993. Provisional estimates are given in parentheses. -- indicates data not available. (0) indicates less than 1 metric ton.

YEAR	JAPAN		TAIWAN		KOREA		UNITED STATES		CANADA ¹		NEW ZEALAND		FRENCH POLYNESIA		FIJI		AUSTRALIA ²		NEW CALEDONIA		TONGA		GRAND TOTAL
	POLE & LINE	LONG LINE	GILL NET	LONG LINE	GILL NET	LONG LINE	TROLL	LONG LINE	TROLL	LONG LINE	TROLL	LONG LINE	TROLL	LONG LINE	TROLL	LONG LINE	POLE & LINE	SPORT	LONG LINE	LONG LINE	LONG LINE	LONG LINE	
1952		210																					210
1953		1,091																					1,091
1954		10,200																					10,200
1955		8,420																					8,420
1956		6,220																					6,220
1957		9,764																					9,764
1958		21,558				146																	21,704
1959		19,344				456																	19,800
1960	45	23,756				610																	24,411
1961		25,628				330																	25,958
1962		38,880				599																	39,479
1963	16	33,500				1,367																	34,883
1964		21,435				2,911																	24,346
1965		19,305				3,500																	22,805
1966		23,401				11,700																	35,101
1967		16,640				14,900					5												43,296
1968		7,707				10,900					14												31,045
1969		5,559				11,000																	26,154
1970		6,560				12,000					50						200						33,499
1971		4,386				12,900											(200)						(33,573)
1972		2,806				15,600					248						(200)						(35,668)
1973		2,636				16,000					484						(200)						(37,062)
1974		2,084				9,631					898						(200)						(30,096)
1975		1,117				8,747					646						(200)						(27,781)
1976		1,906				9,492					25						(200)						(25,323)
1977		2,240				12,026					621						(200)						(37,019)
1978		2,520				11,048					1,686						(200)						(36,396)
1979		2,350				10,838					814						(200)						(29,288)
1980	19	2,488				10,389					1,468						100						32,644
1981	8	4,856				17,393					2,085						(100)						39,037
1982	1	4,900				14,504					2,434												34,684
1983	2	4,828	32			5,921					744						50						106
1984	3	3,607	1,581			6,686					2,773						(50)						143
1985	3	3,746	1,928			16,436					3,253						(50)						135
1986		4,466	1,936			18,655					1,911						(50)						174
1987		4,085	919			8,646					1,227						(50)						206
1988		6,894	4,271			7,029					330						(50)						252
1989		5,148	13,263			4,996					5,161	19					(50)						242
1990		(5,148)	5,567			3,232					2,525	249					(50)						195
1991		(5,148)	0			(0)					2,464	325					(50)						153
1992		(5,148)	(0)			(0)					3,856	706					(50)						174
1993		(5,148)	(0)			(0)					(3,856)	(706)					(100)						(28,742)
						(1,531)																	(26,754)

Japan gill net, Taiwan gill net, Korean longline, Canadian troll, New Zealand longline and troll, French Polynesia longline and troll, Fiji longline and troll, Australia longline and sport, New Caledonia longline, and Tonga longline data from SPC 1993. Status of tuna fisheries in the SPC area during 1992, with annual catches for 1922-1938 and 1952-1992. Working paper 2, Standing committee on tuna and billfish.

Other data from SPAR workshop no. 4.

¹ Troll landings for Canada and Fiji combined in 1991.

Table 3. Sampling results of the 1992 and 1993 U.S. north Pacific albacore troll fisheries.

	NO. OF VESSEL TRIPS		METRIC TONS LANDED		NO. FISH LANDED		COVERAGE RATE		AVG FORK LENGTH (cm)	TOTAL DAYS OF EFFORT (est.)	CATCH RATE (fish/day)
	TOTAL	CATCH/EFFORT SAMPLED	TOTAL	CATCH/EFFORT SAMPLED	TOTAL (est.)	SAMPLED (MEASURED)	CATCH/EFFORT	LENGTH-FREQUENCY			
1993	1,887	169	6,254	1,119	917,941	10,885	18%	1.19%	69	24,470	38
1992	1,440	285	4,572	1,715	798,286	41,123	38%	5.15%	64	15,666	54

Table 4. Sampling results of the 1992-93 and 1991-92 U.S. south Pacific albacore troll fisheries.

	NO. OF VESSEL TRIPS		METRIC TONS LANDED		NO. FISH LANDED		COVERAGE RATE		AVG FORK LENGTH (cm)	TOTAL DAYS OF EFFORT (est.)	CATCH RATE (fish/day)
	TOTAL	CATCH/EFFORT SAMPLED	TOTAL	CATCH/EFFORT SAMPLED	TOTAL (est.)	SAMPLED (MEASURED)	CATCH/EFFORT	LENGTH-FREQUENCY			
1992-93	62	10	1,028	172	173,081	1,720	17%	0.99%	63	3,846	45
1991-92	150	84	3,016	1,808	398,152	5,009	60%	1.26%	69	4,679	85

MAY 1993

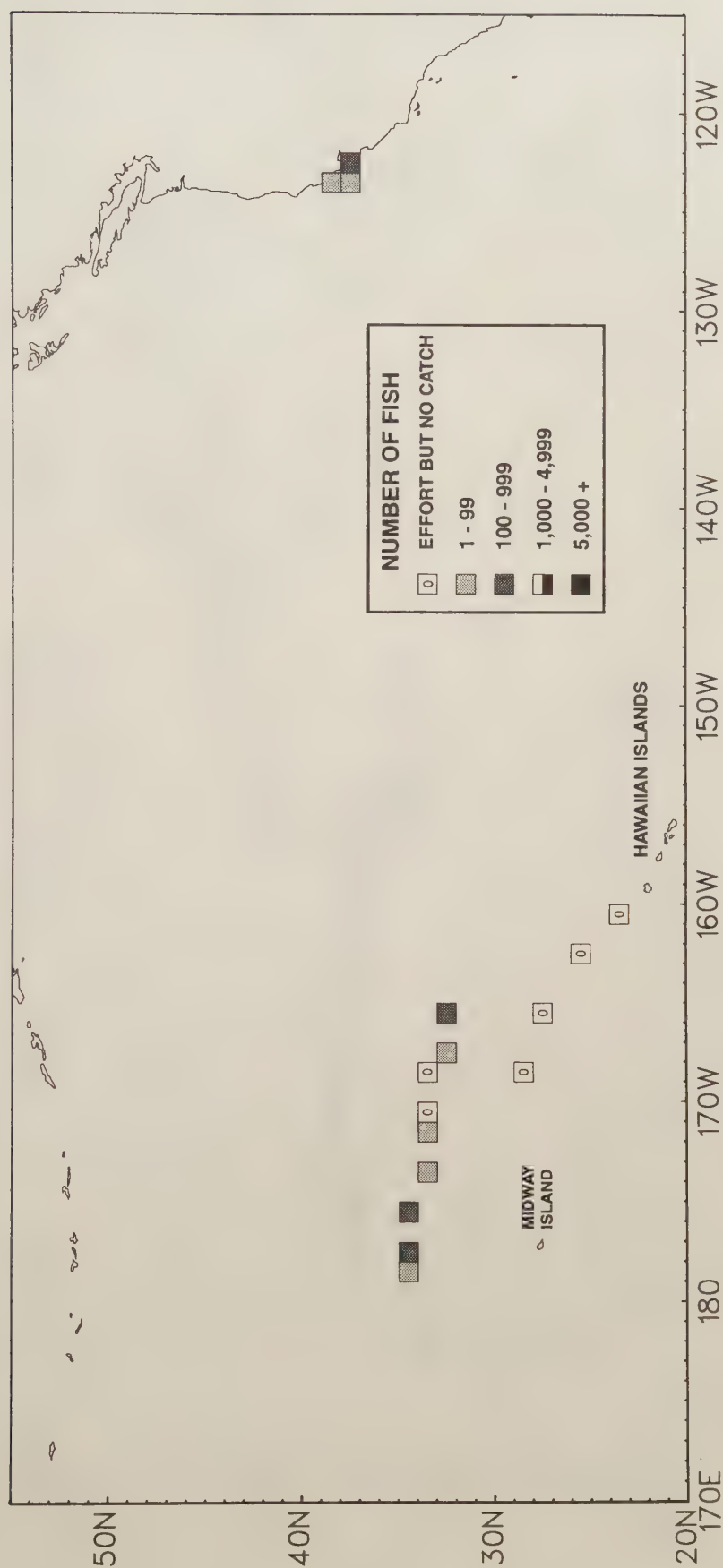


Figure 1a. Sampled U.S. north Pacific albacore catches for May, 1993.

JUNE 1993

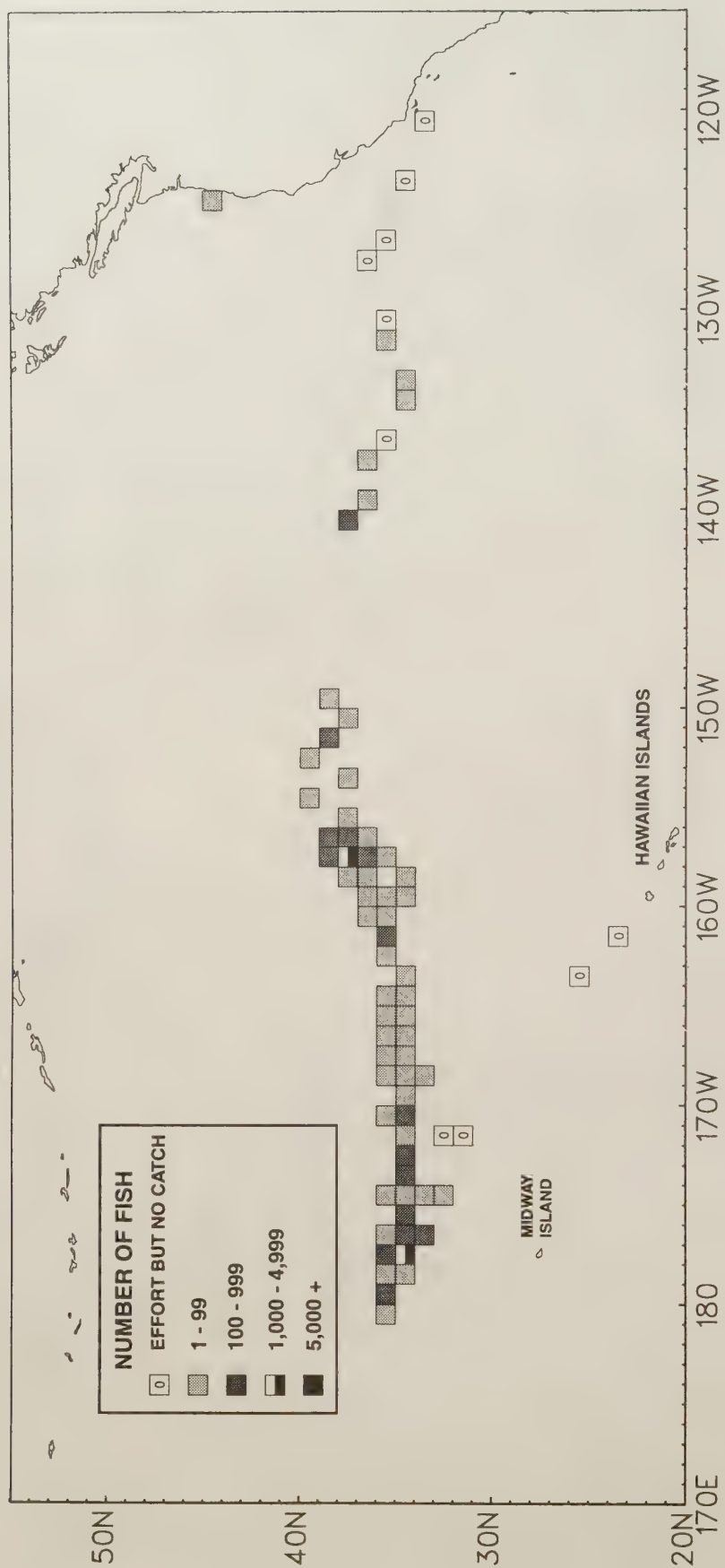


Figure 1b. Sampled U.S. north Pacific albacore catches for June, 1993.

JULY 1993

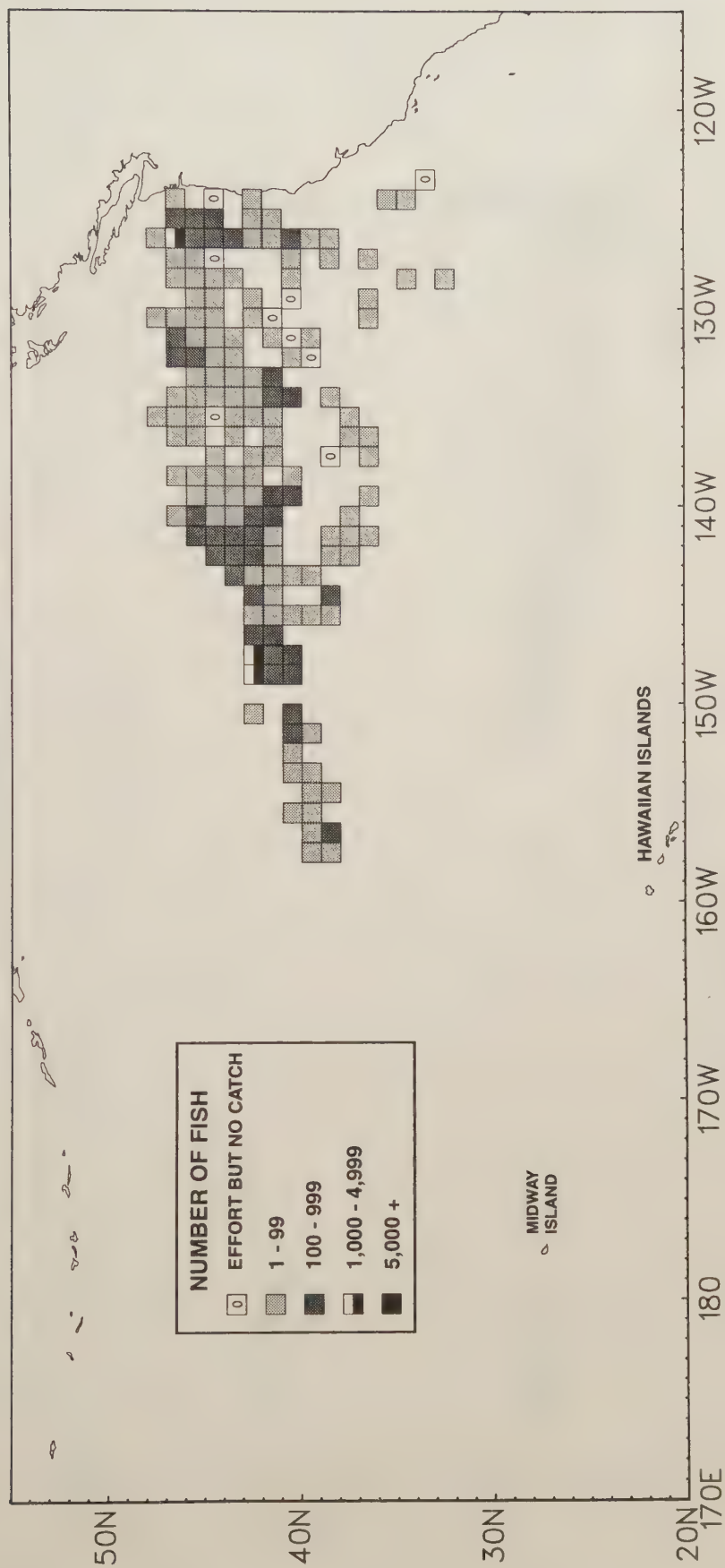


Figure 1c. Sampled U.S. north Pacific albacore catches for July, 1993.

AUGUST 1993

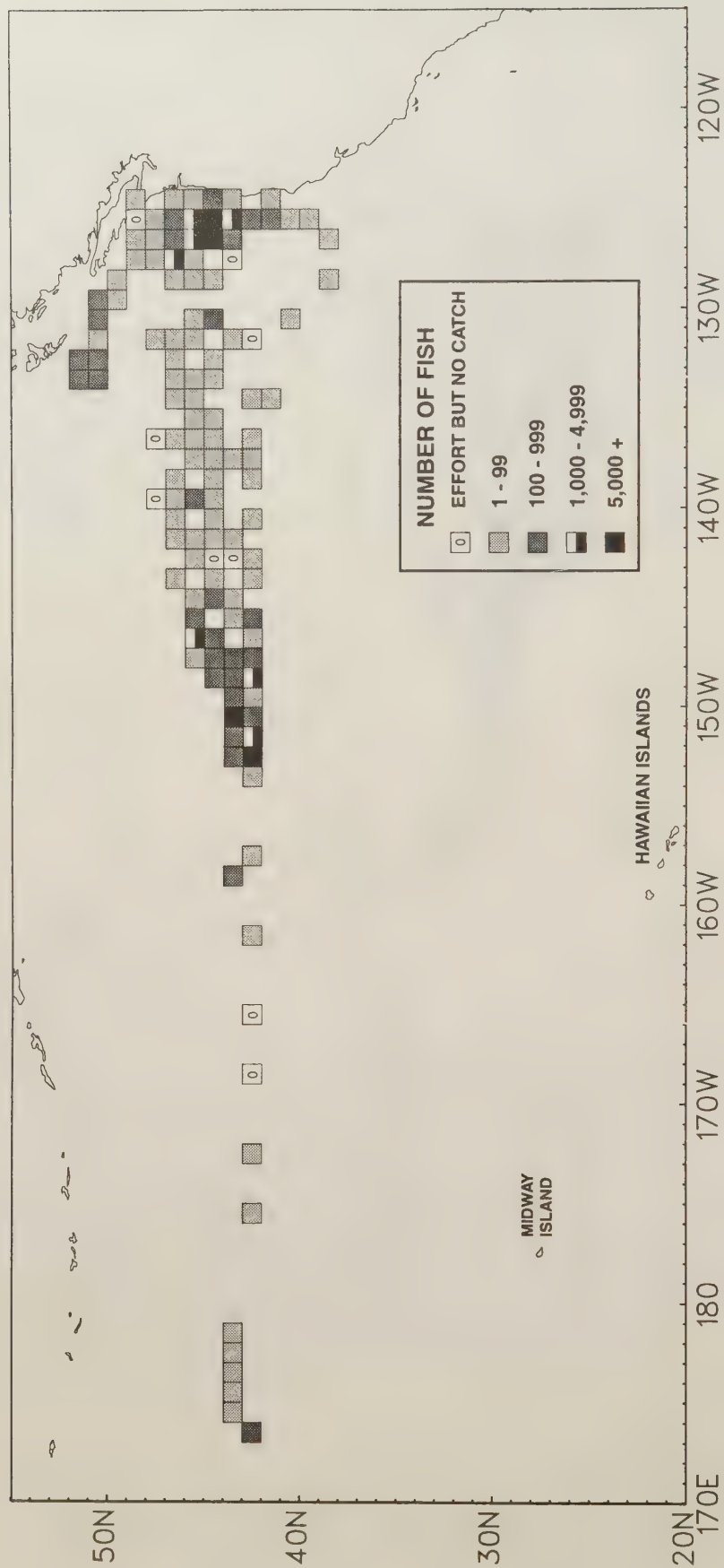


Figure 1d. Sampled U.S. north Pacific albacore catches for August, 1993.

SEPTEMBER 1993

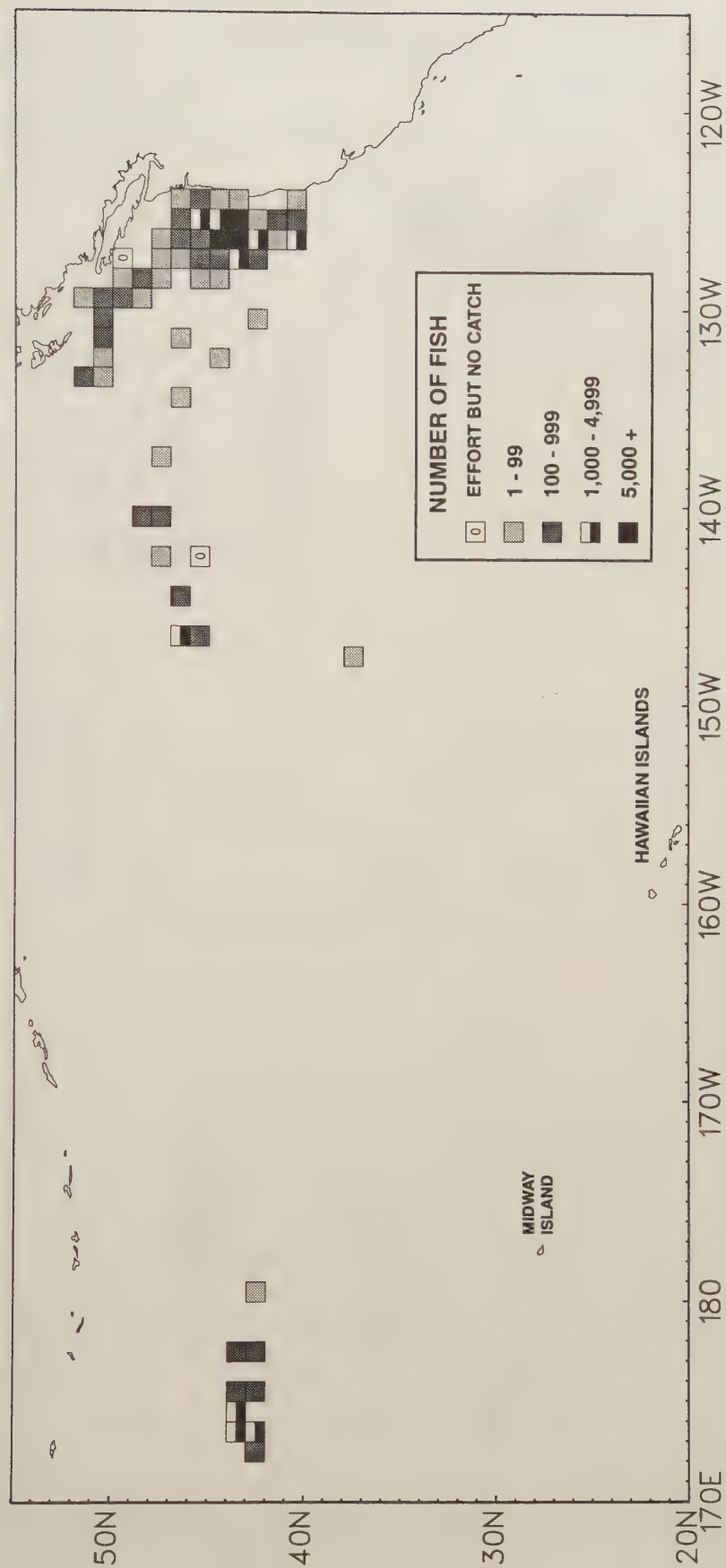


Figure 1e. Sampled U.S. north Pacific albacore catches for September, 1993.

OCTOBER 1993

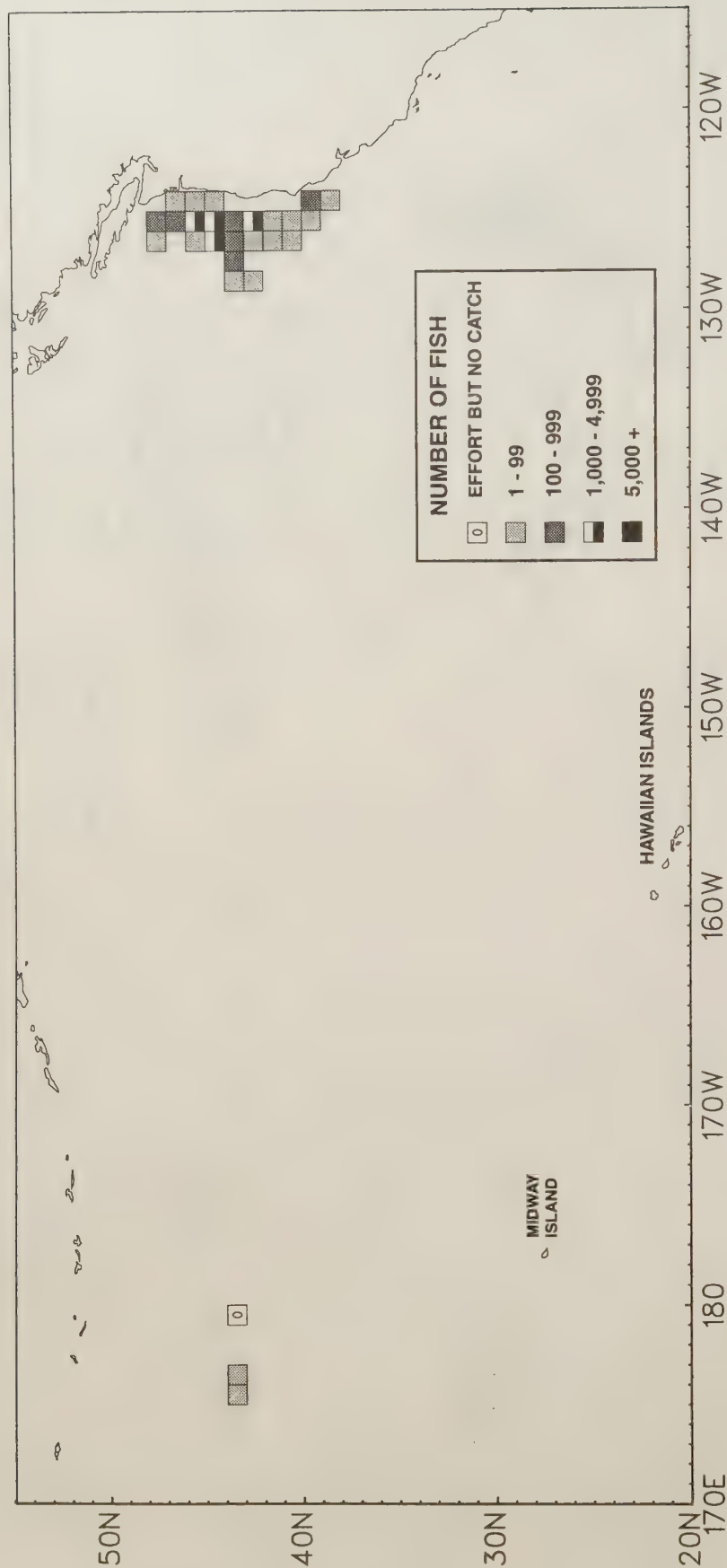


Figure 1f. Sampled U.S. north Pacific albacore catches for October, 1993.

NOVEMBER 1993

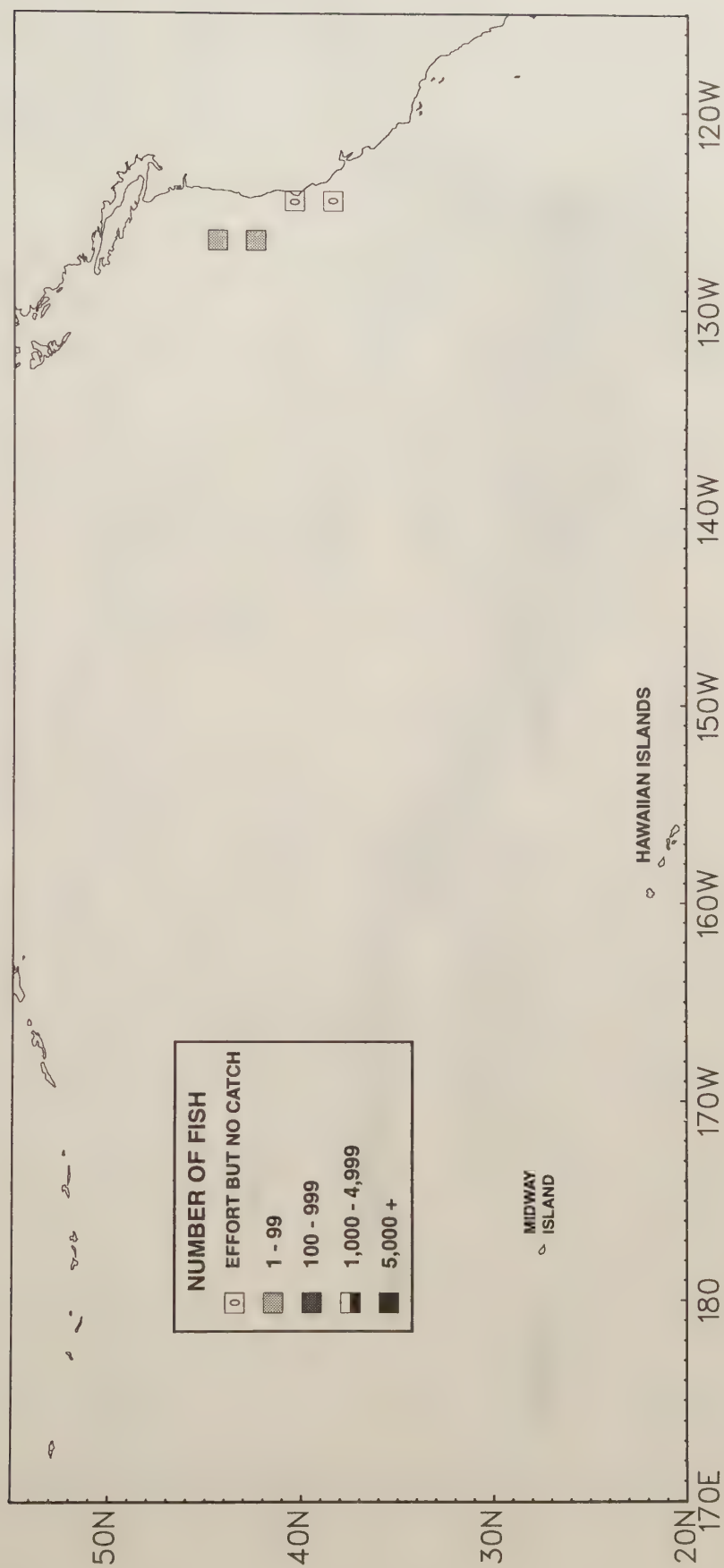


Figure 1g. Sampled U.S. north Pacific albacore catches for November, 1993.

TOTAL CATCH 1993

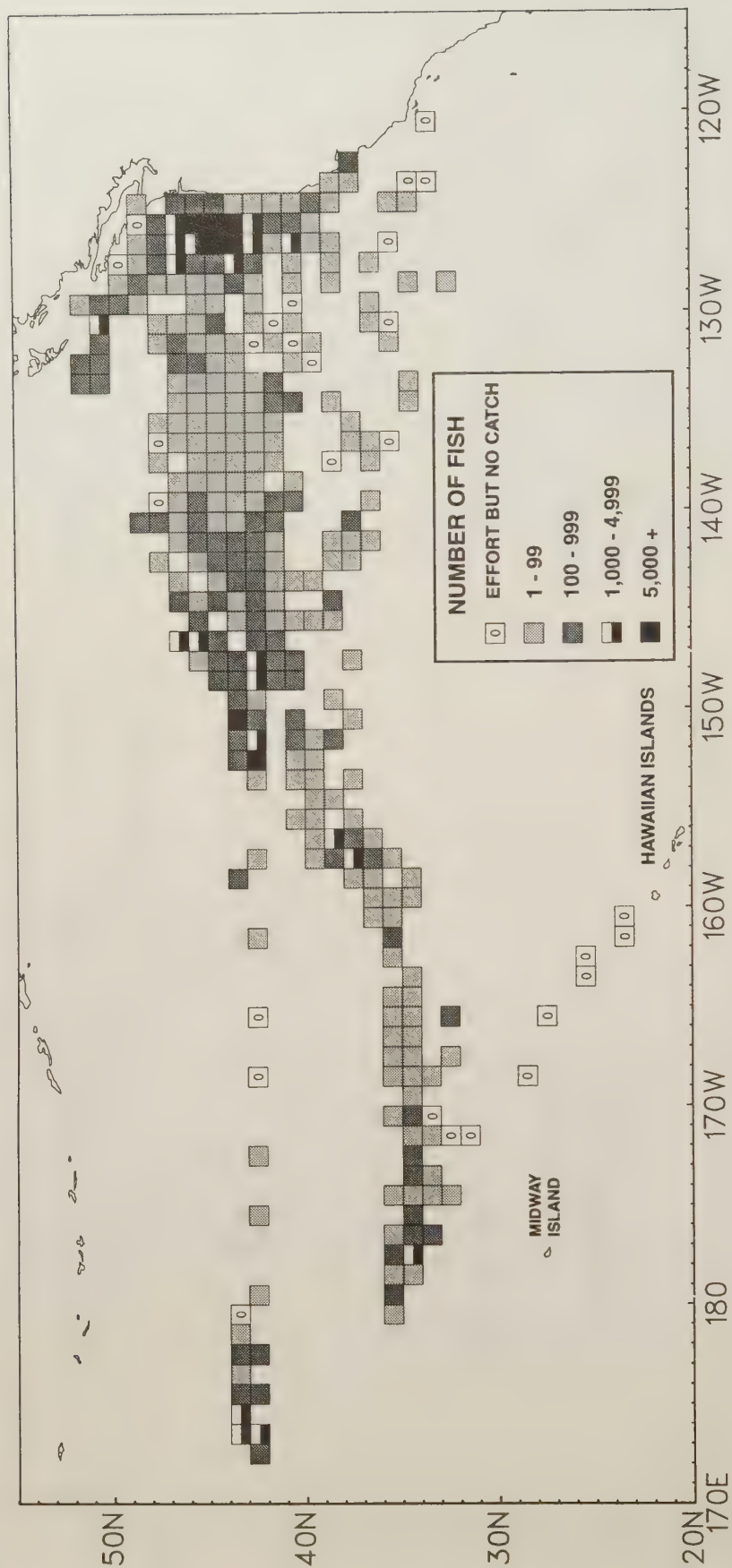


Figure 1h. Sampled U.S. north Pacific albacore catches for the 1993 season.

DECEMBER 1992

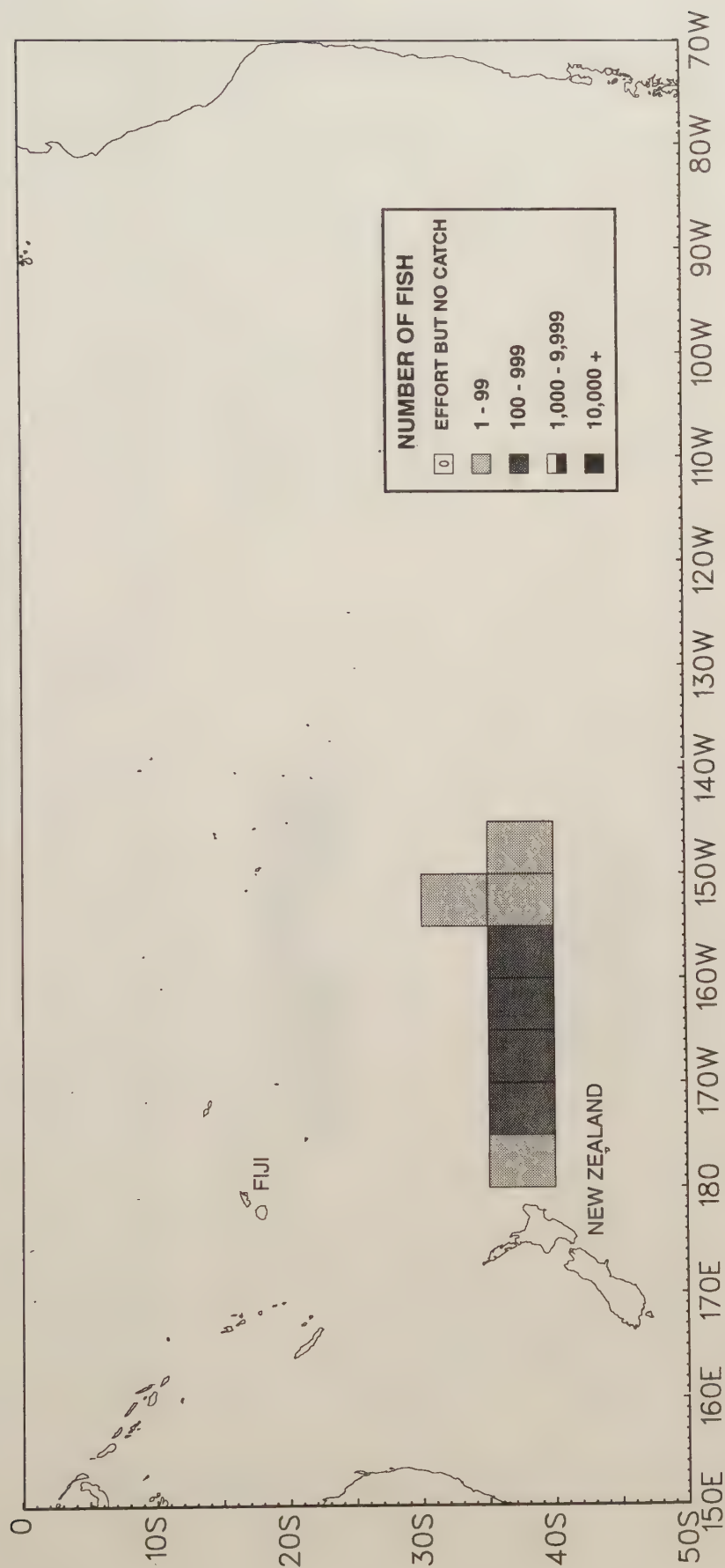


Figure 2a. Sampled U.S. south Pacific albacore catches for December, 1992.

JANUARY 1993

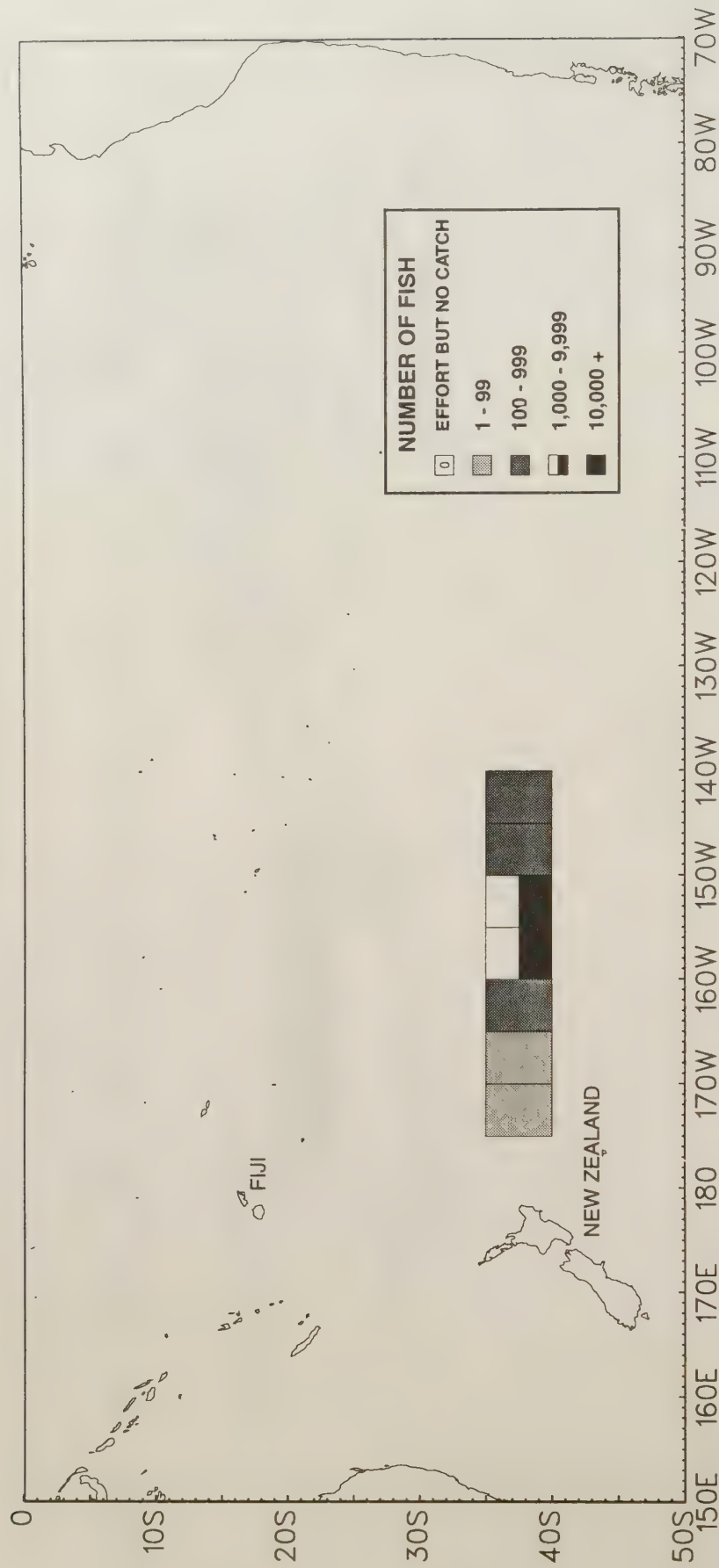


Figure 2b. Sampled U.S. south Pacific albacore catches for January, 1993.

FEBRUARY 1993

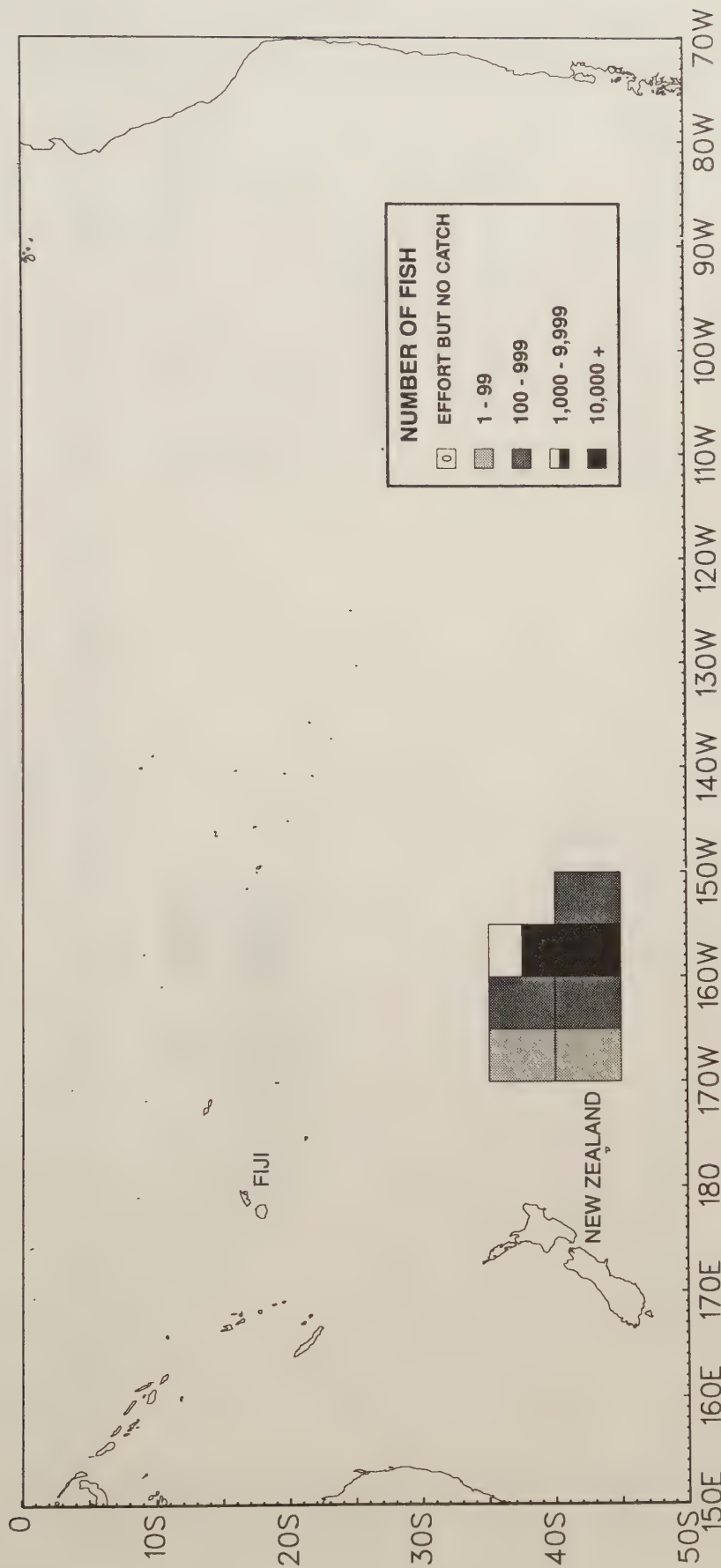


Figure 2c. Sampled U.S. south Pacific albacore catches for February, 1993.

MARCH 1993

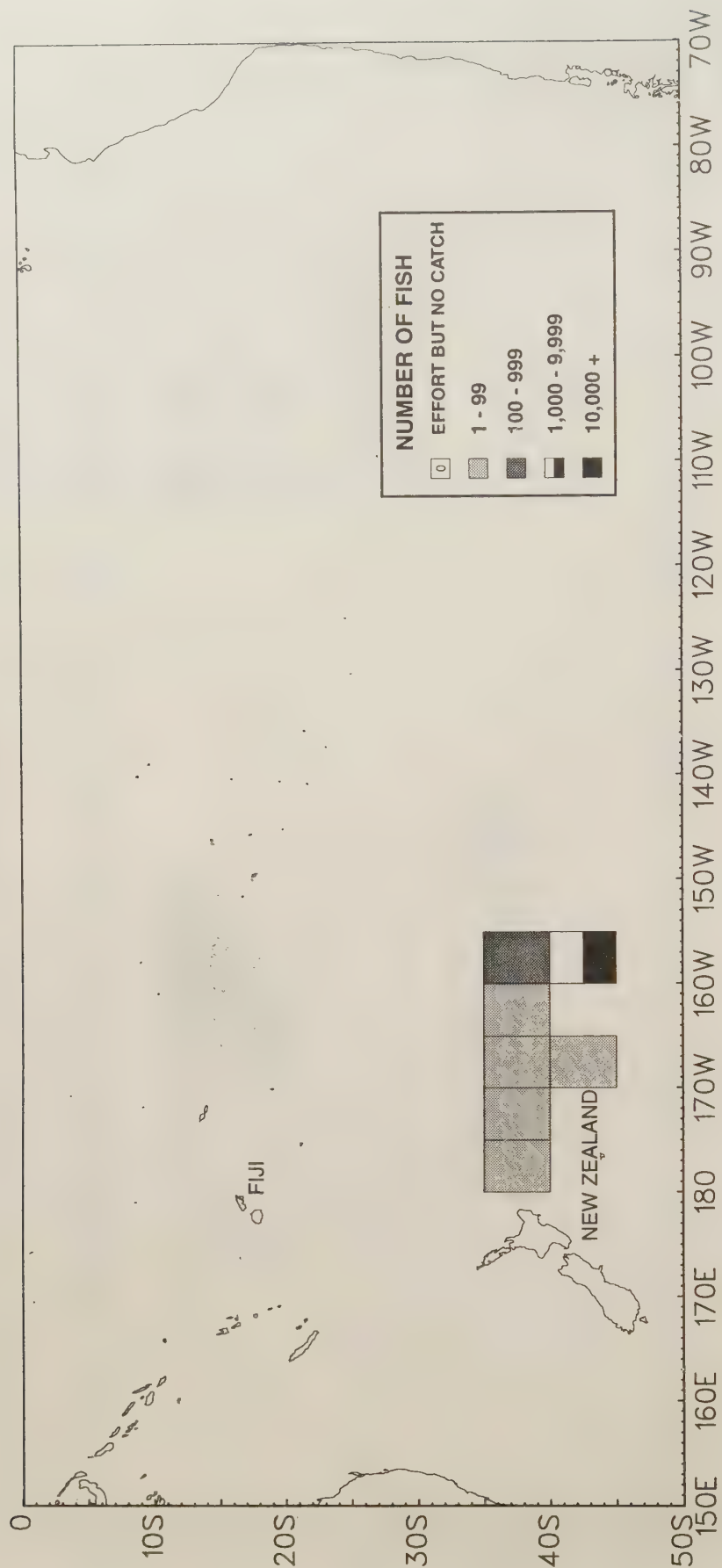


Figure 2d. Sampled U.S. south Pacific albacore catches for March, 1993.

APRIL 1993

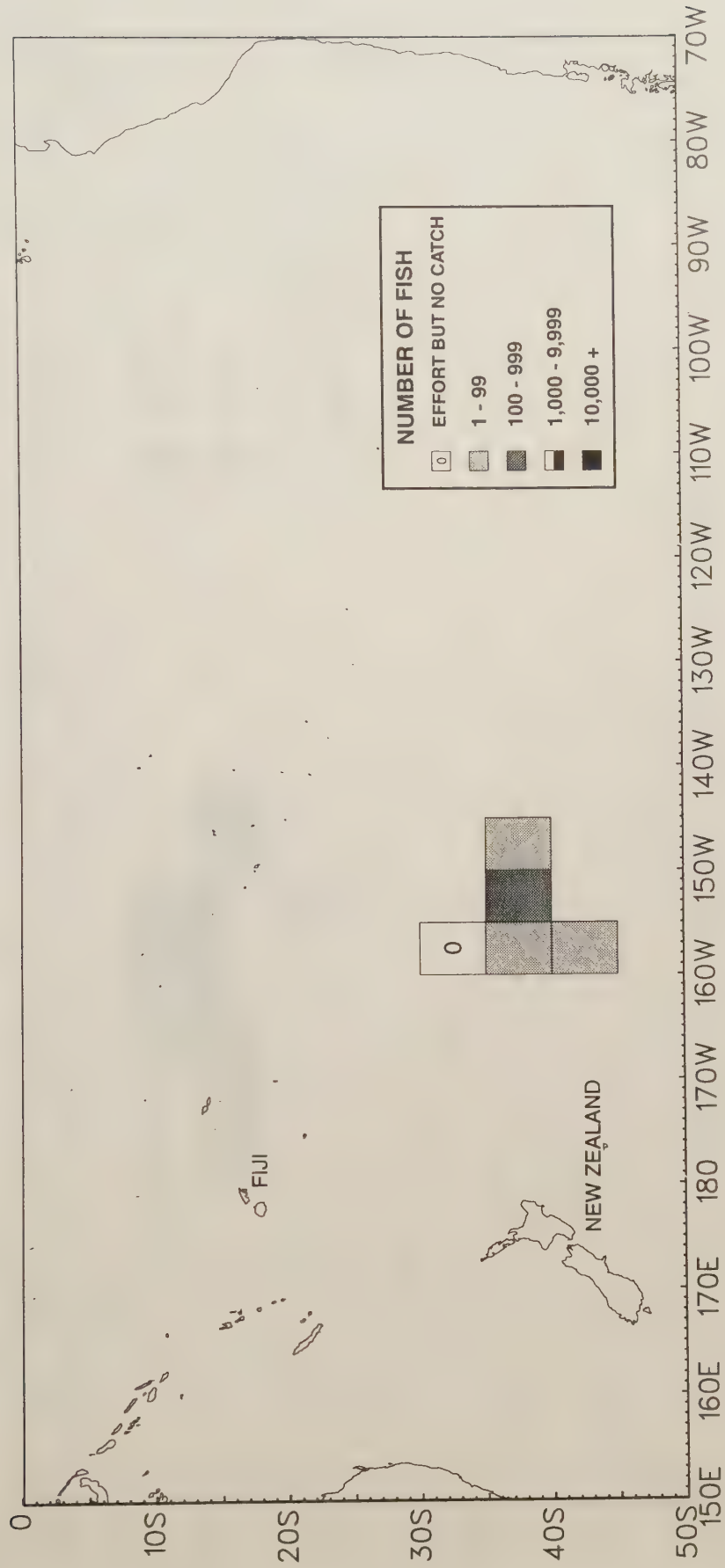


Figure 2e. Sampled U.S. south Pacific albacore catches for April, 1993.

TOTAL CATCH 1992-1993

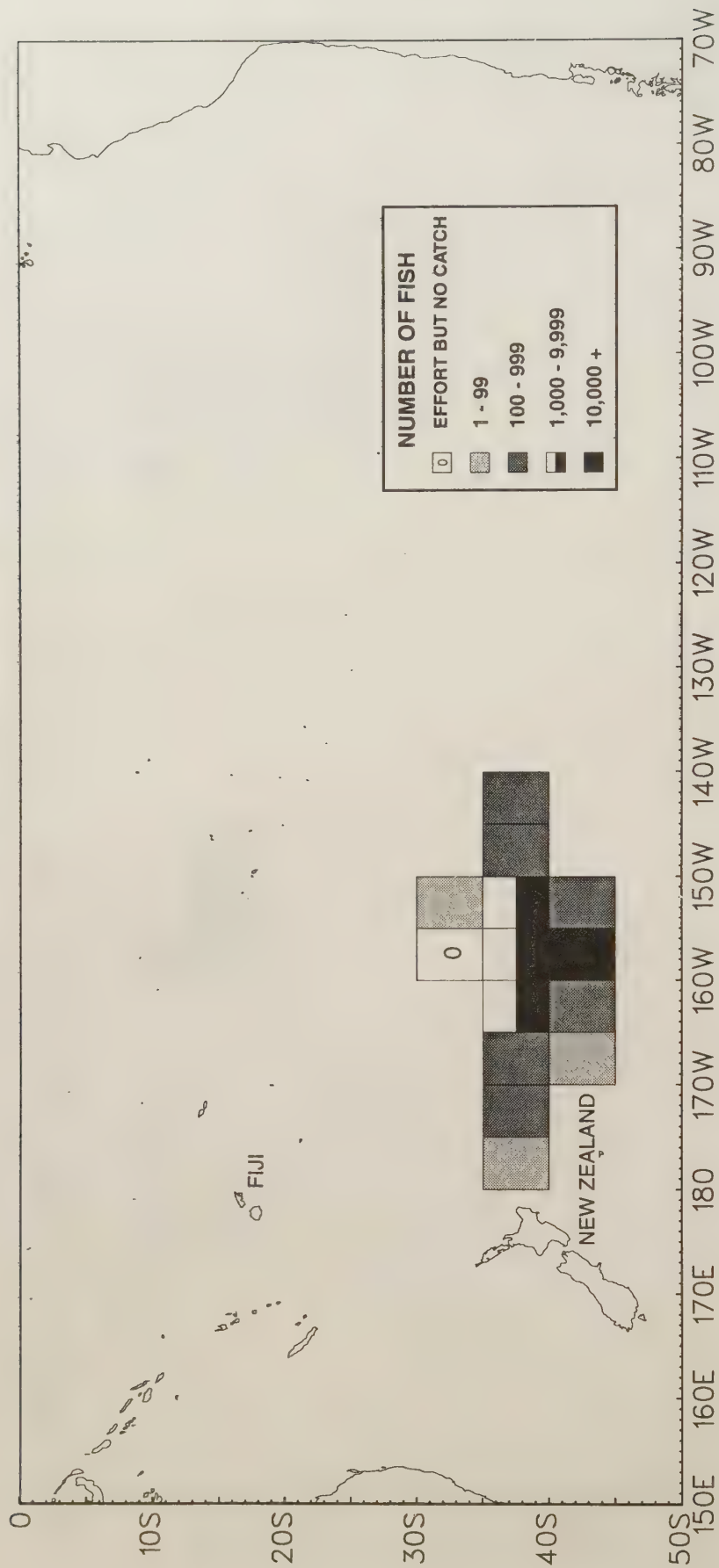


Figure 2f. Sampled U.S. south Pacific albacore catches for the 1992-93 season.

MAY 1993

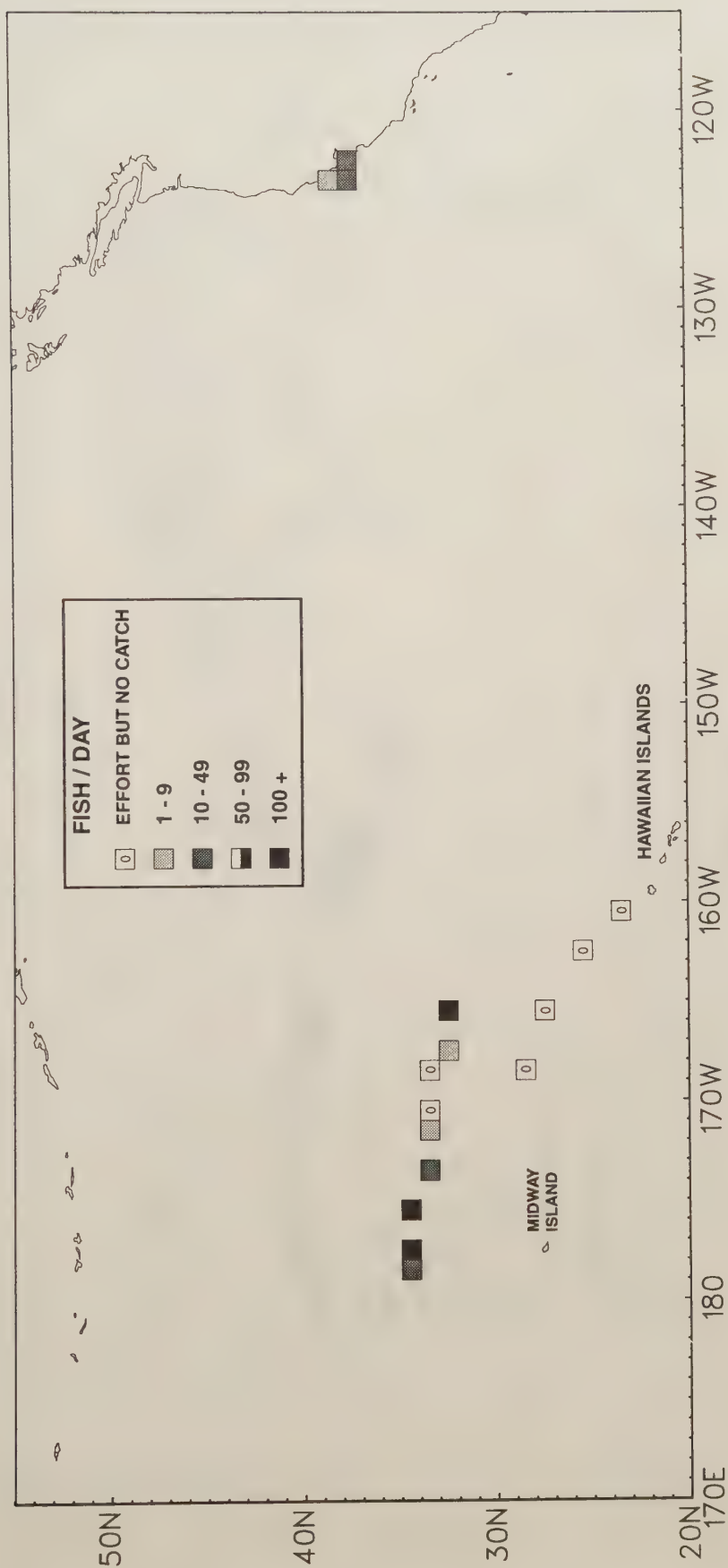


Figure 3a. U.S. north Pacific albacore catch rates for May, 1993

JUNE 1993

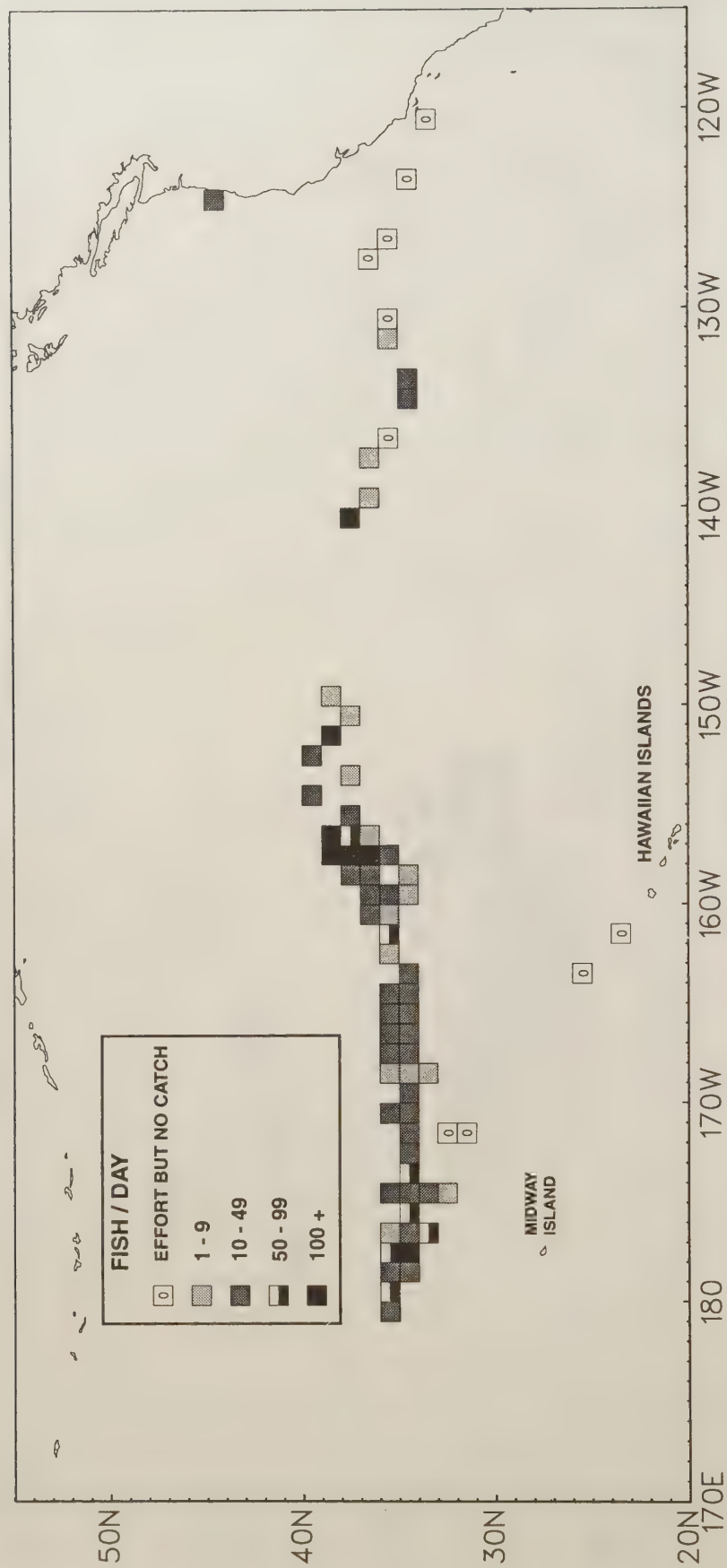


Figure 3b. U.S. north Pacific albacore catch rates for June, 1993

JULY 1993

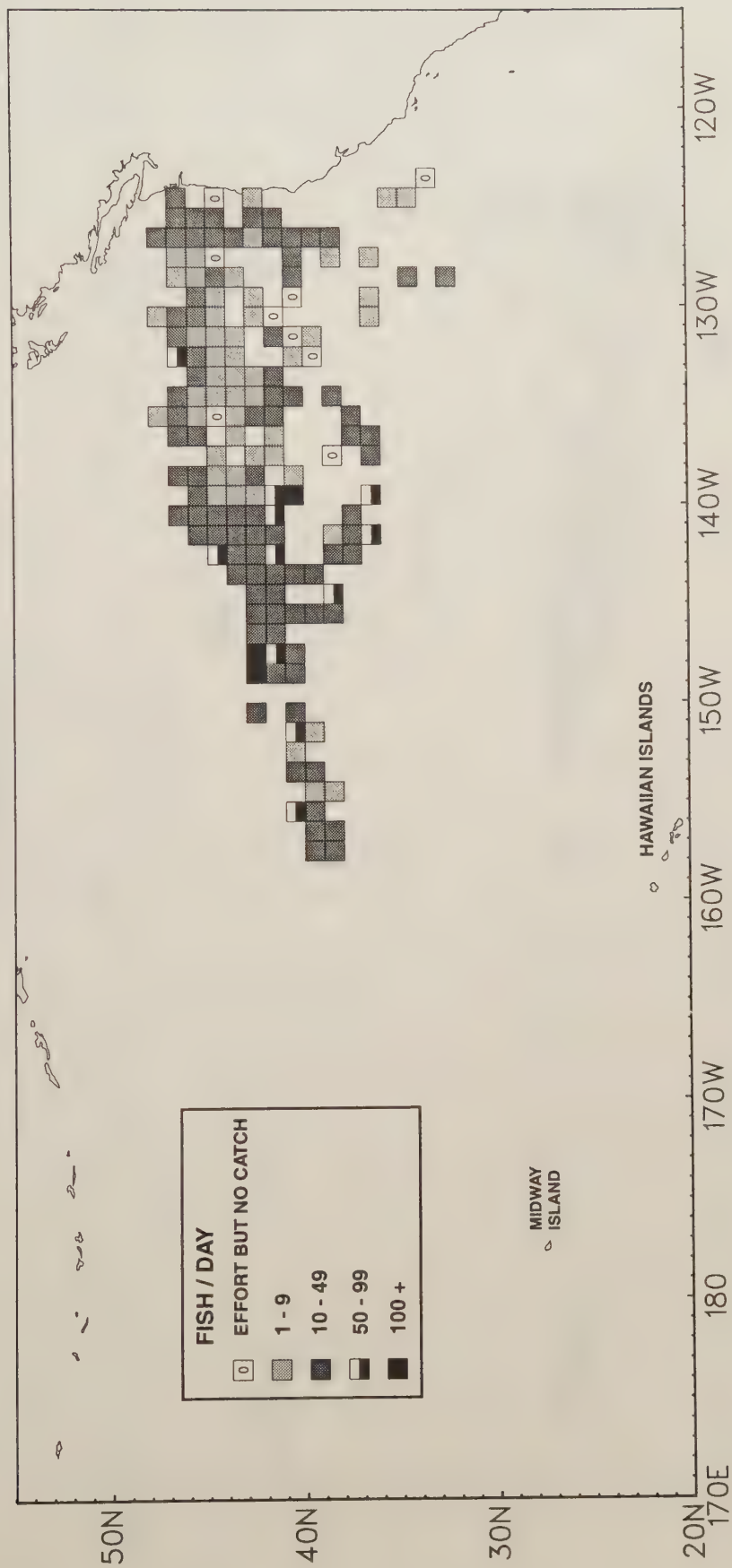


Figure 3c. U.S. north Pacific albacore catch rates for July, 1993

AUGUST 1993

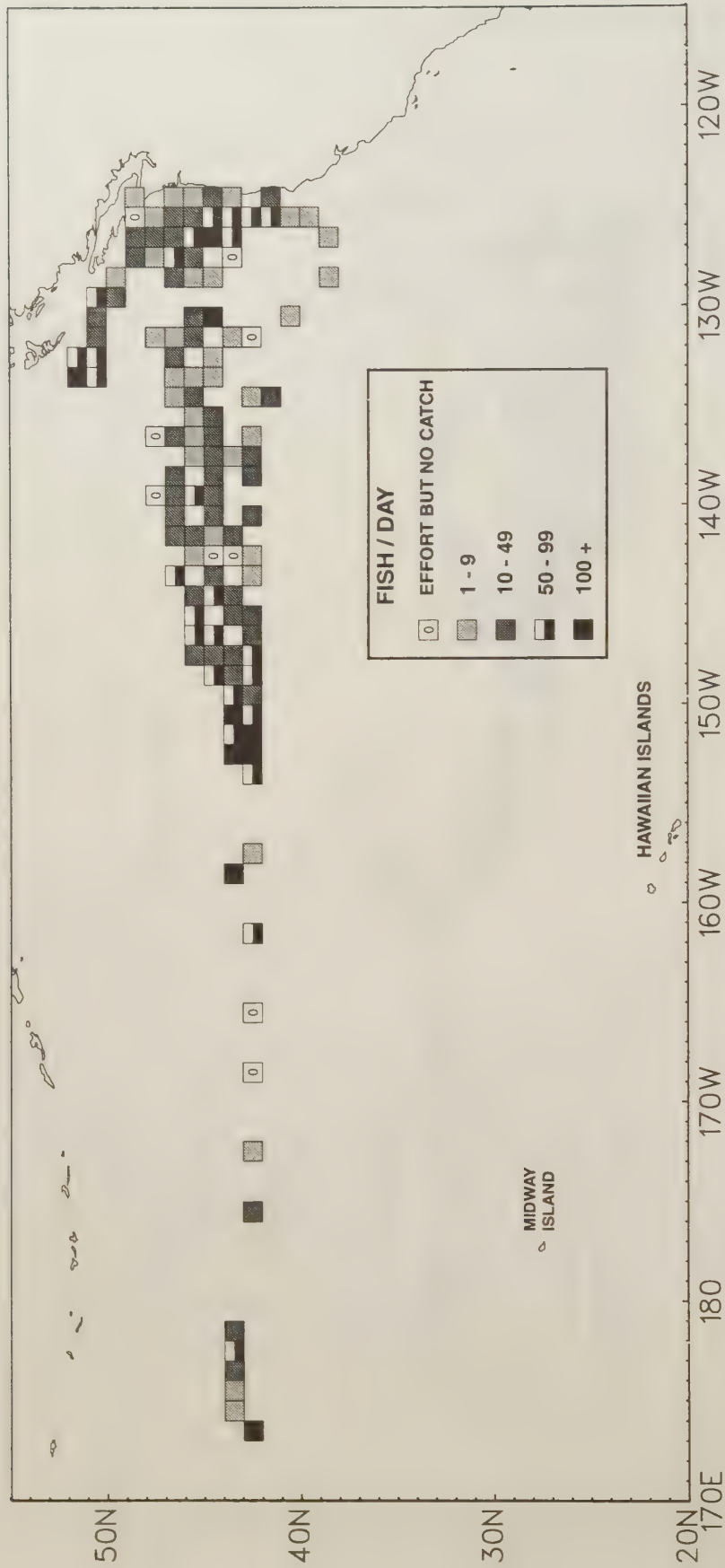


Figure 3d. U.S. north Pacific albacore catch rates for August, 1993

SEPTEMBER 1993

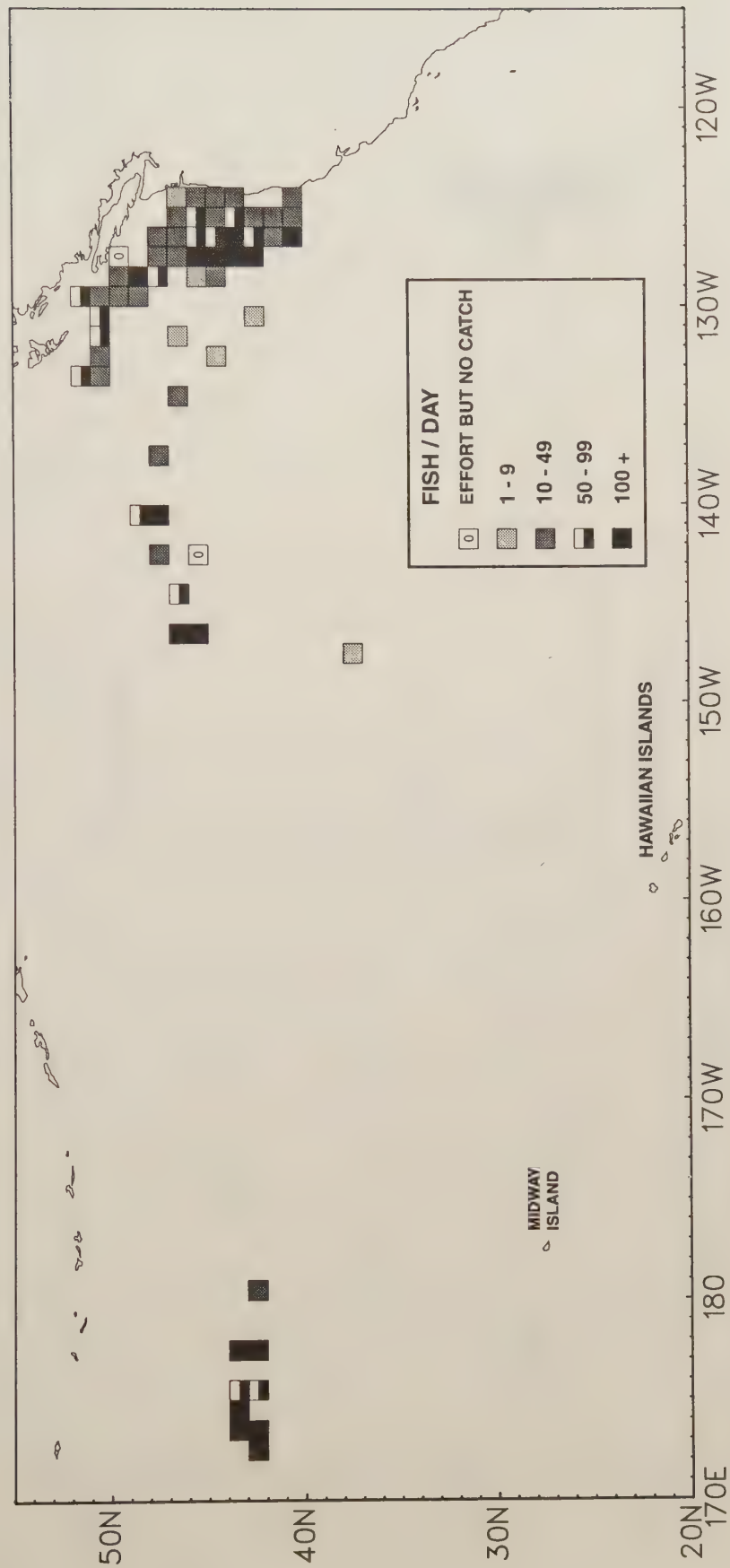


Figure 3e. U.S. north Pacific albacore catch rates for September, 1993

OCTOBER 1993

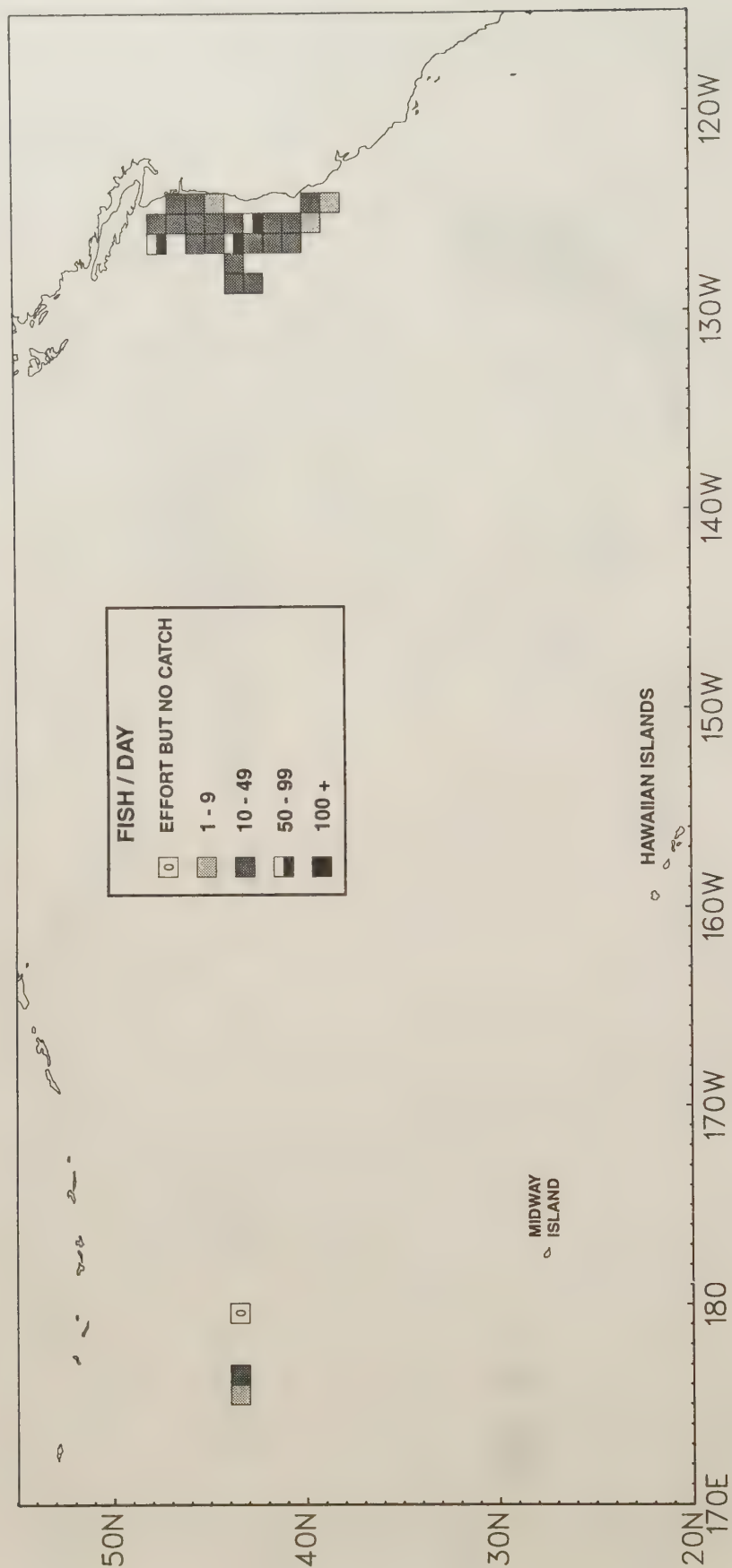


Figure 3f. U.S. north Pacific albacore catch rates for October, 1993

NOVEMBER 1993

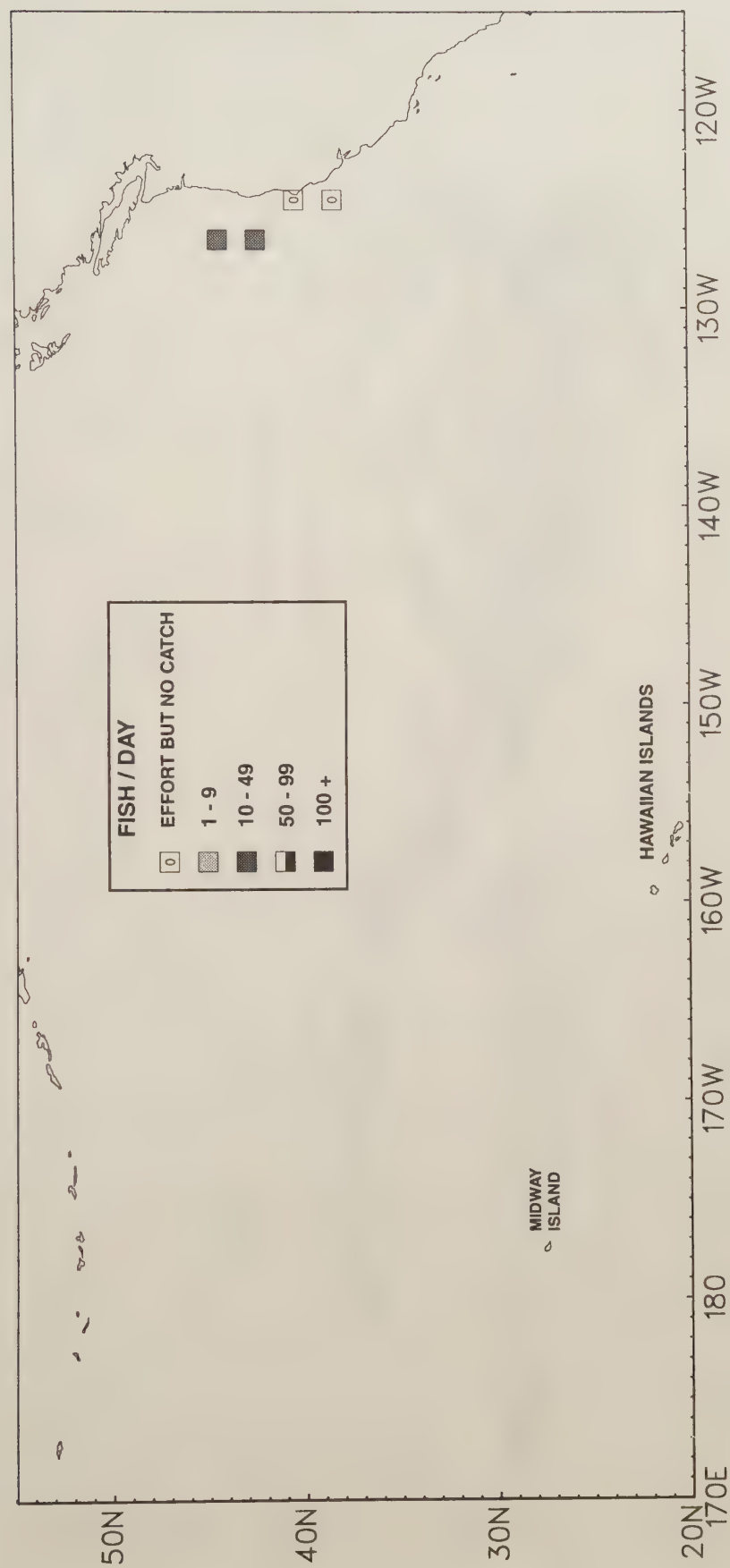


Figure 3g. U.S. north Pacific albacore catch rates for November, 1993

TOTAL CATCH RATE 1993

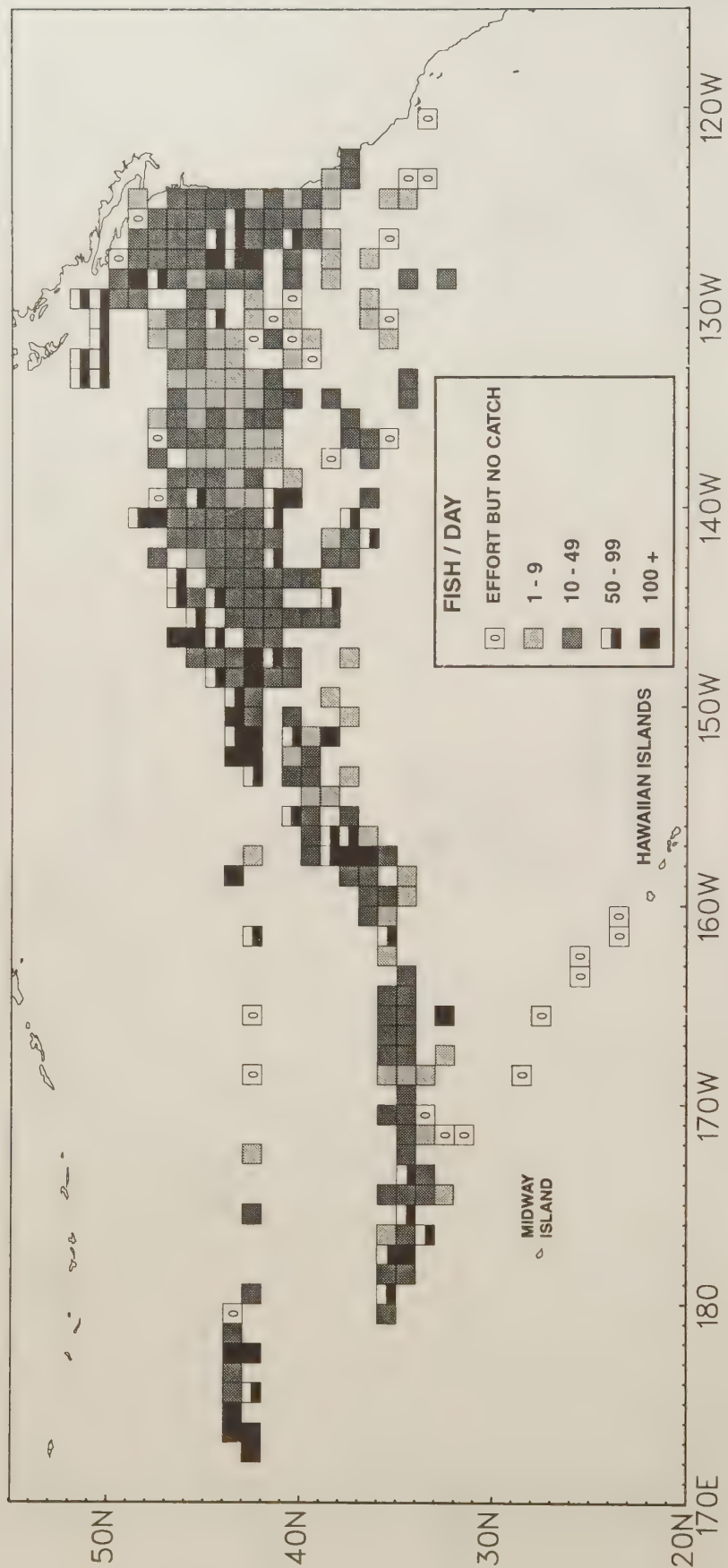


Figure 3h. U.S. north Pacific albacore catch rates for the 1993 season

DECEMBER 1992

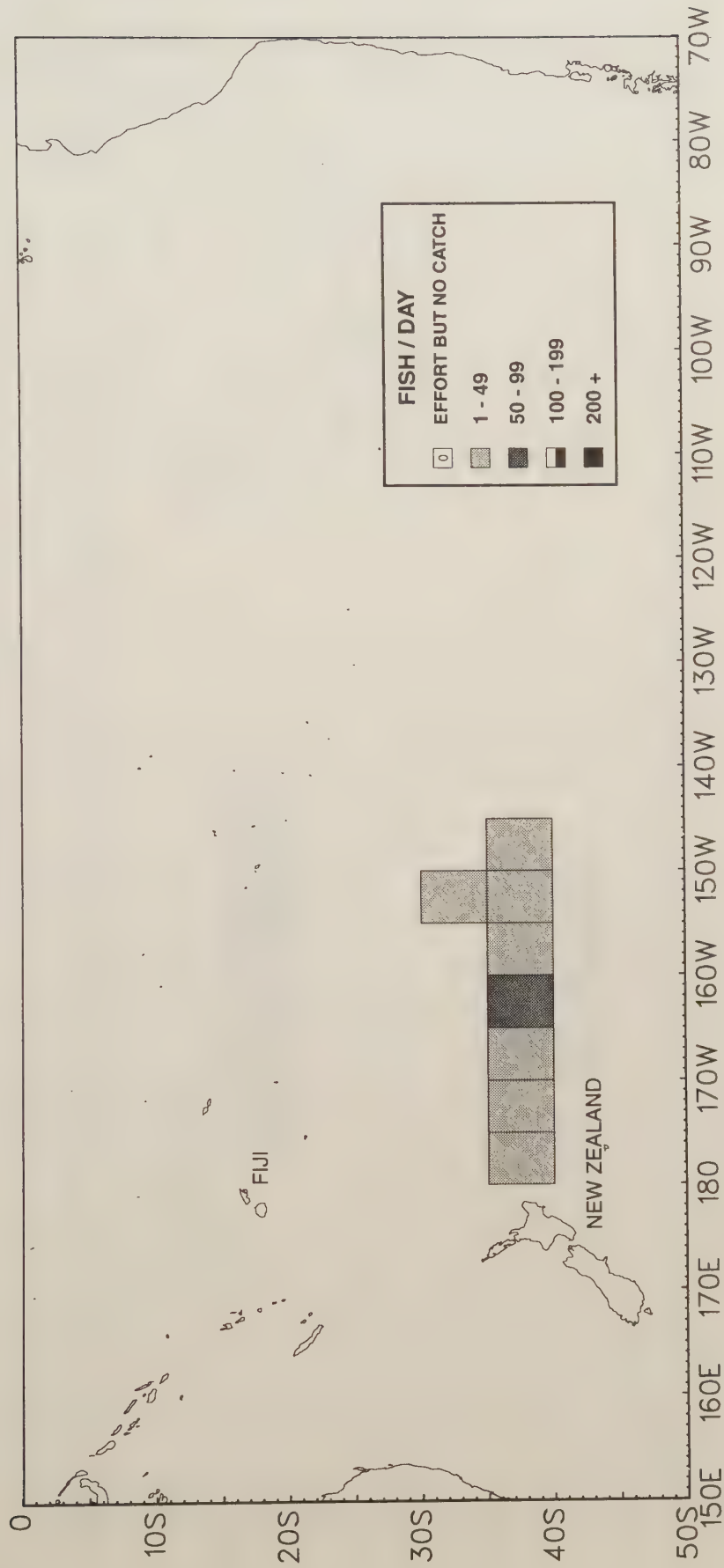


Figure 4a. U.S. south Pacific albacore catch rates for December, 1992.

JANUARY 1993

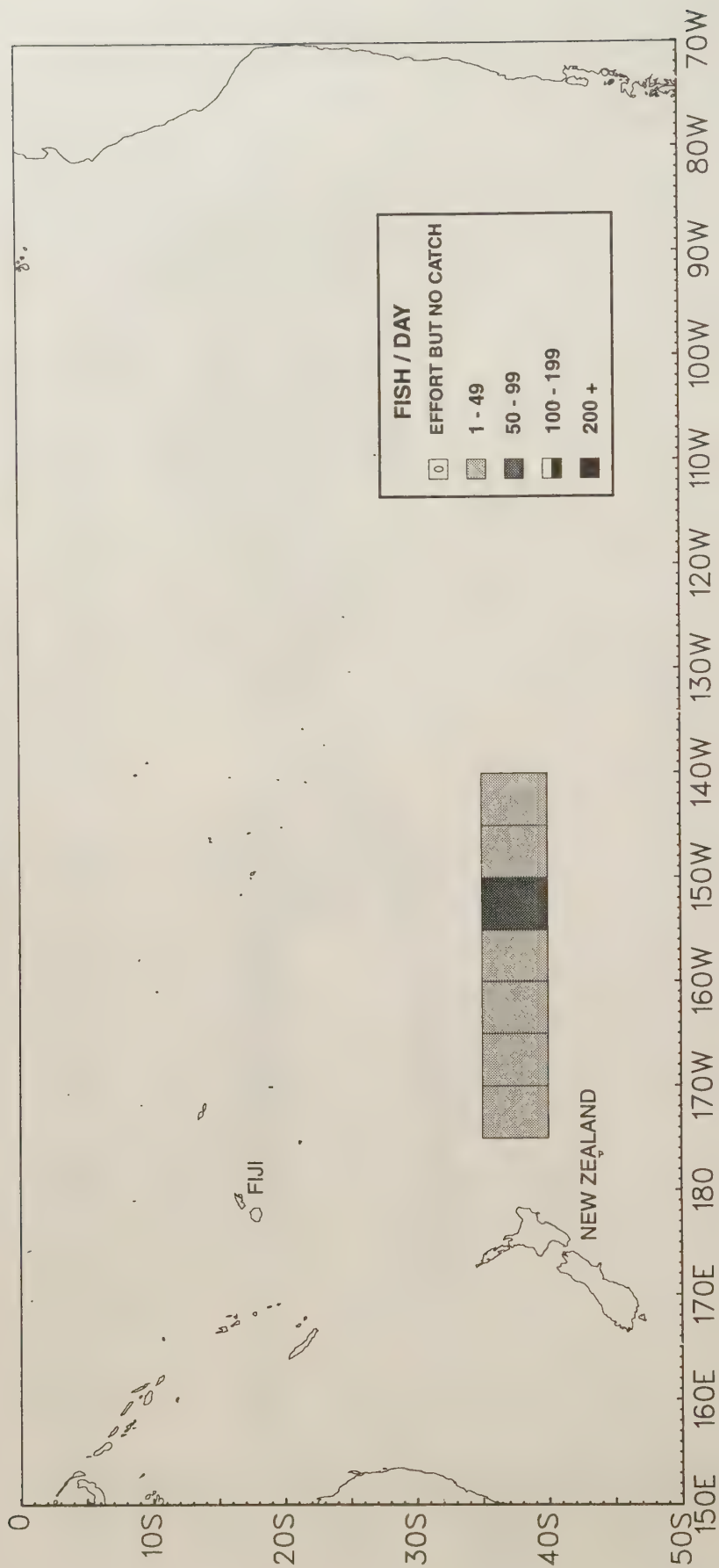


Figure 4b. U.S. south Pacific albacore catch rates for January, 1993.

FEBRUARY 1993

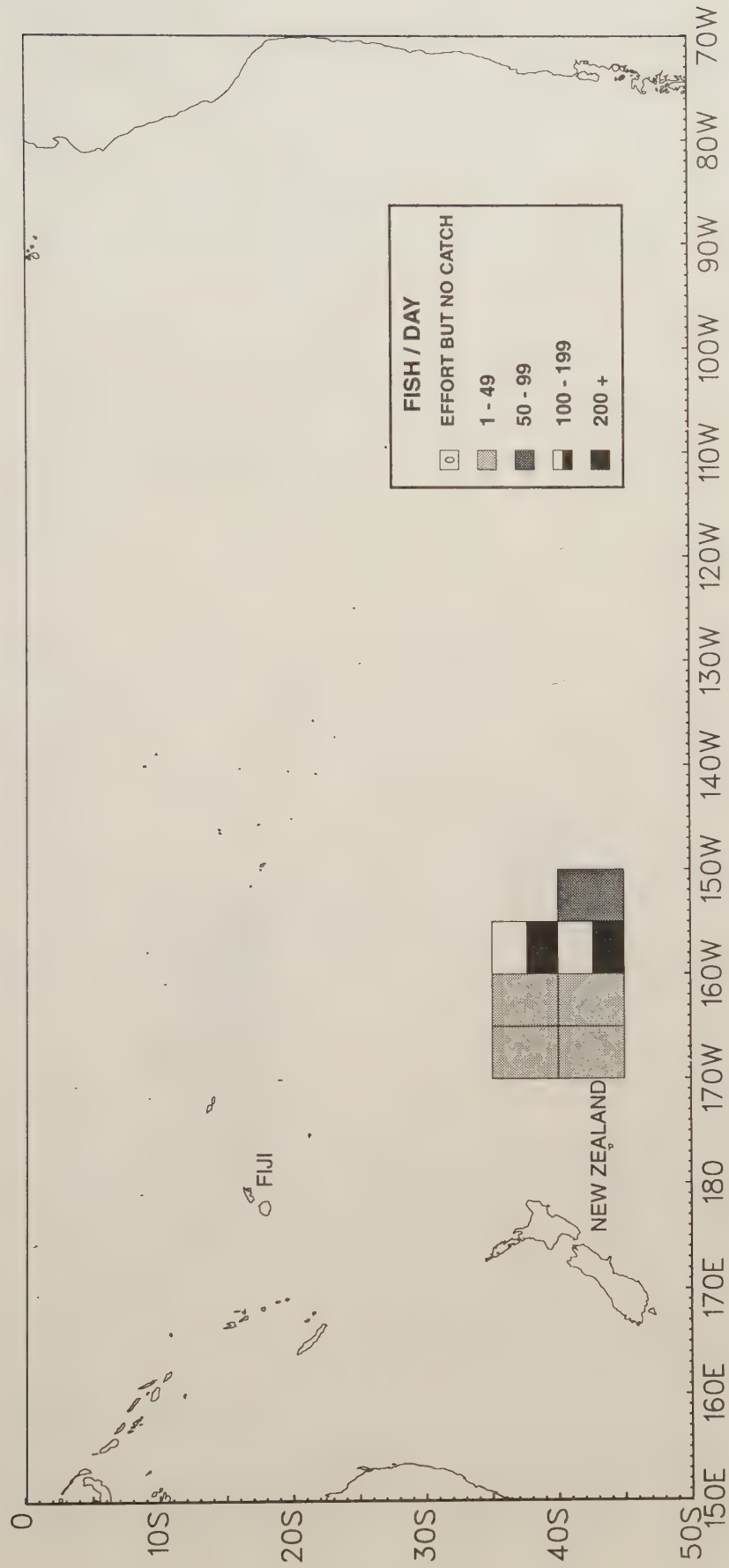


Figure 4c. U.S. south Pacific albacore catch rates for February, 1993.

MARCH 1993

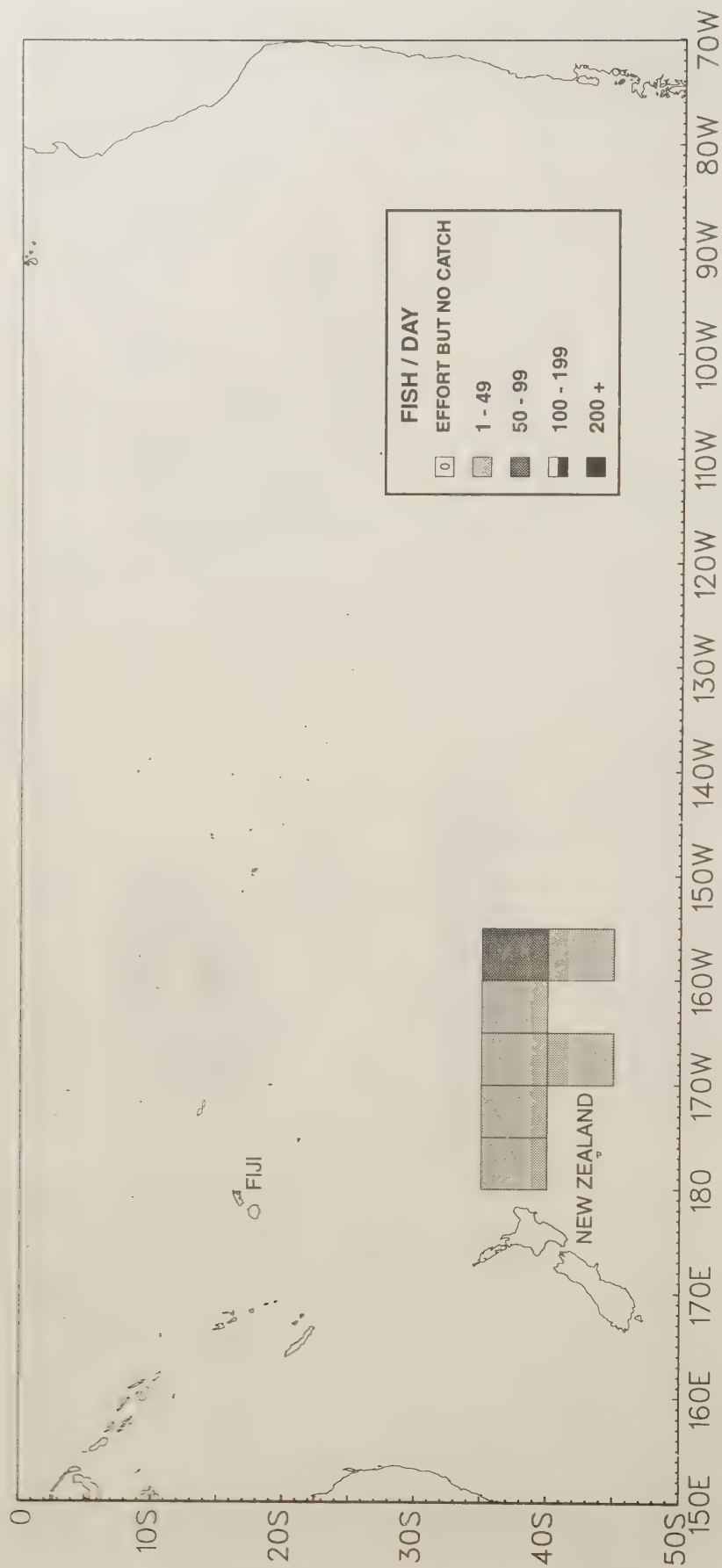


Figure 4d. U.S. south Pacific albacore catch rates for March, 1993.

APRIL 1993

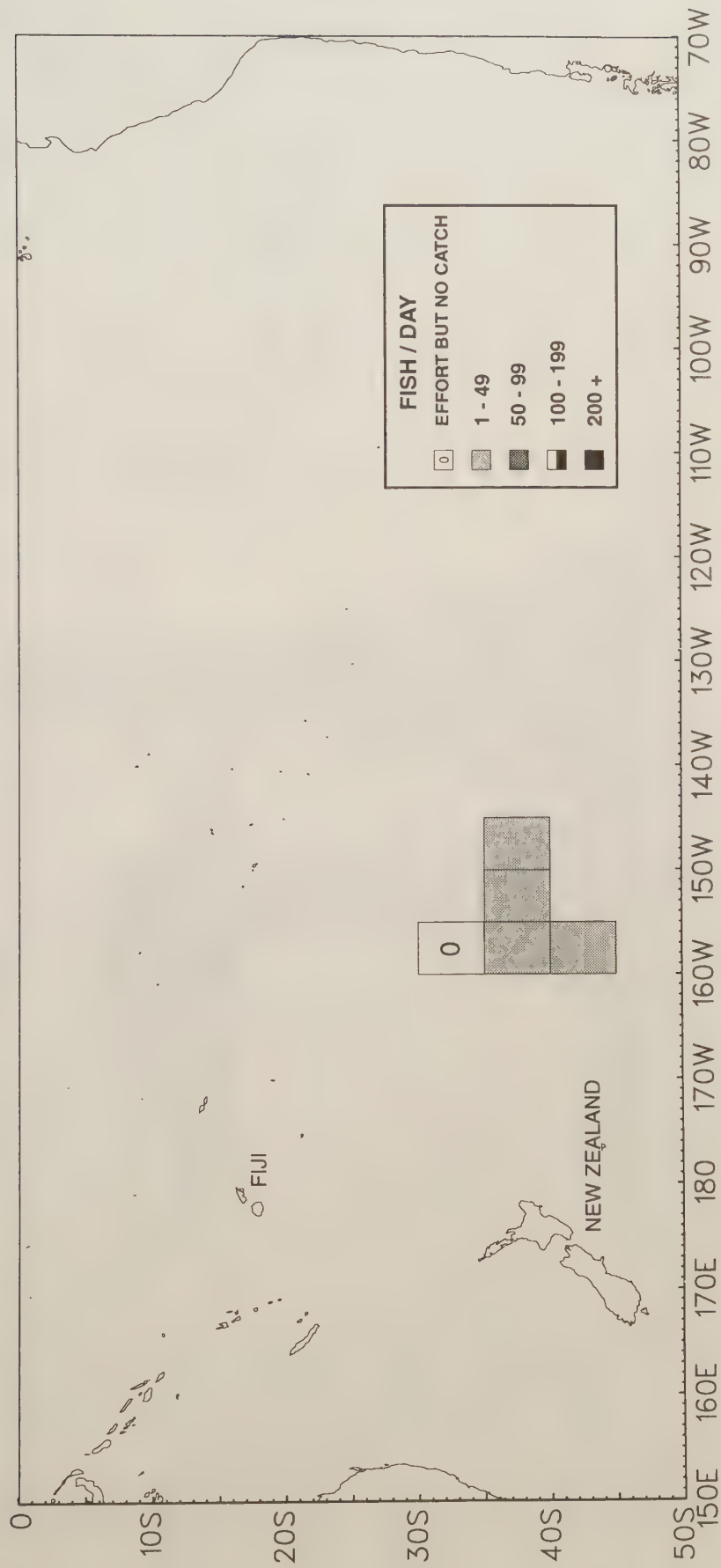


Figure 4e. U.S. south Pacific albacore catch rates for April, 1993.

TOTAL CATCH RATE 1992-1993

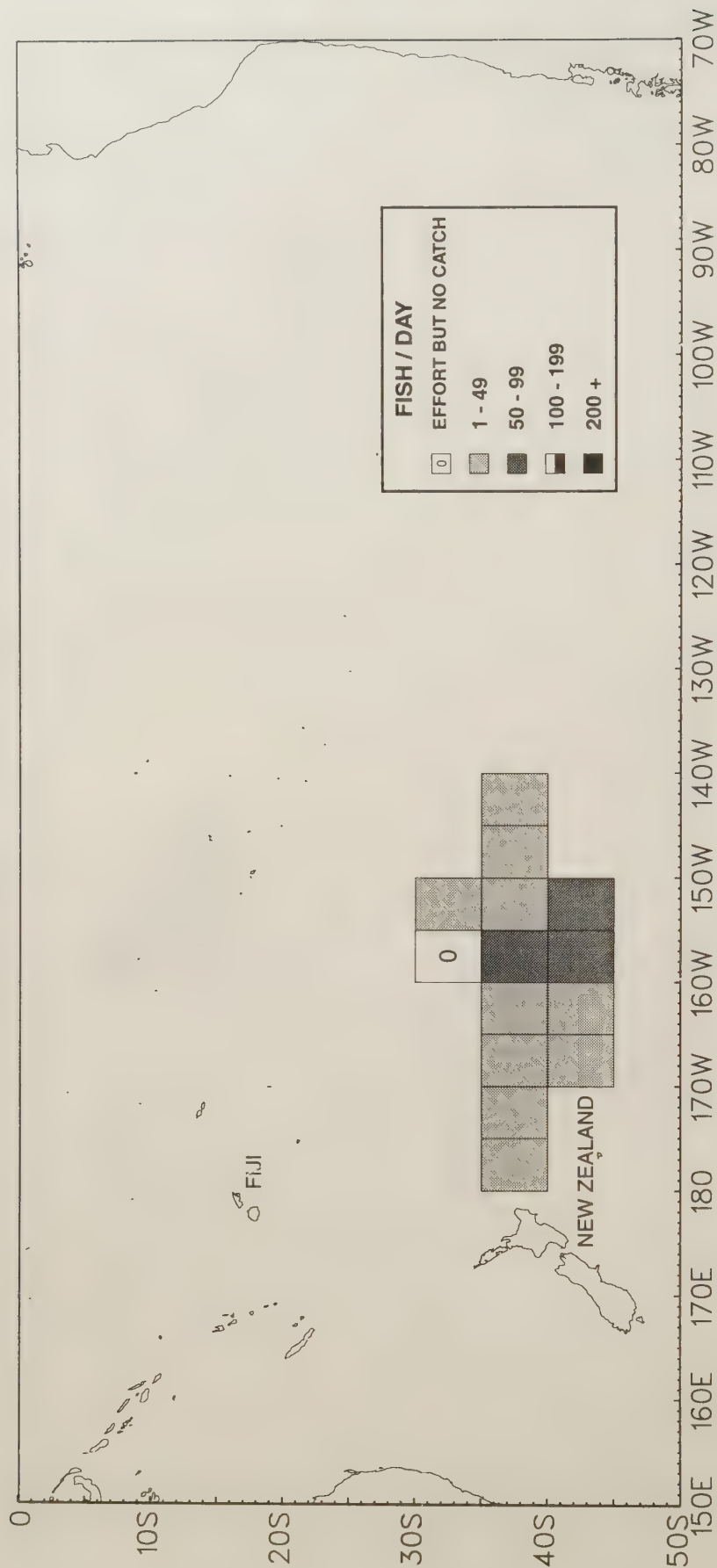


Figure 4f. U.S. south Pacific albacore catch rates for the 1992-93 season.

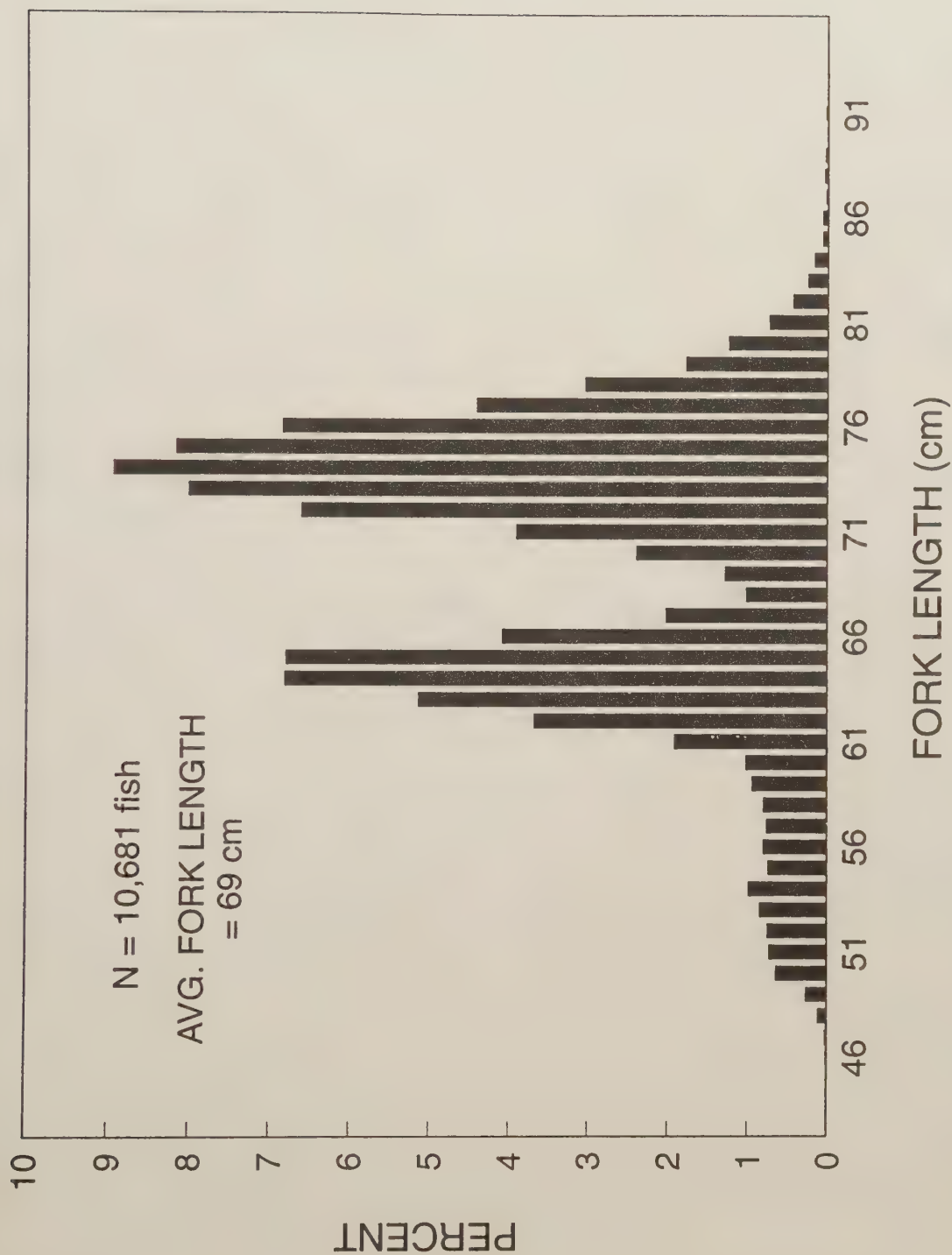


Figure 5. Length-frequencies of albacore sampled from the 1993 U.S. north Pacific troll fishery.

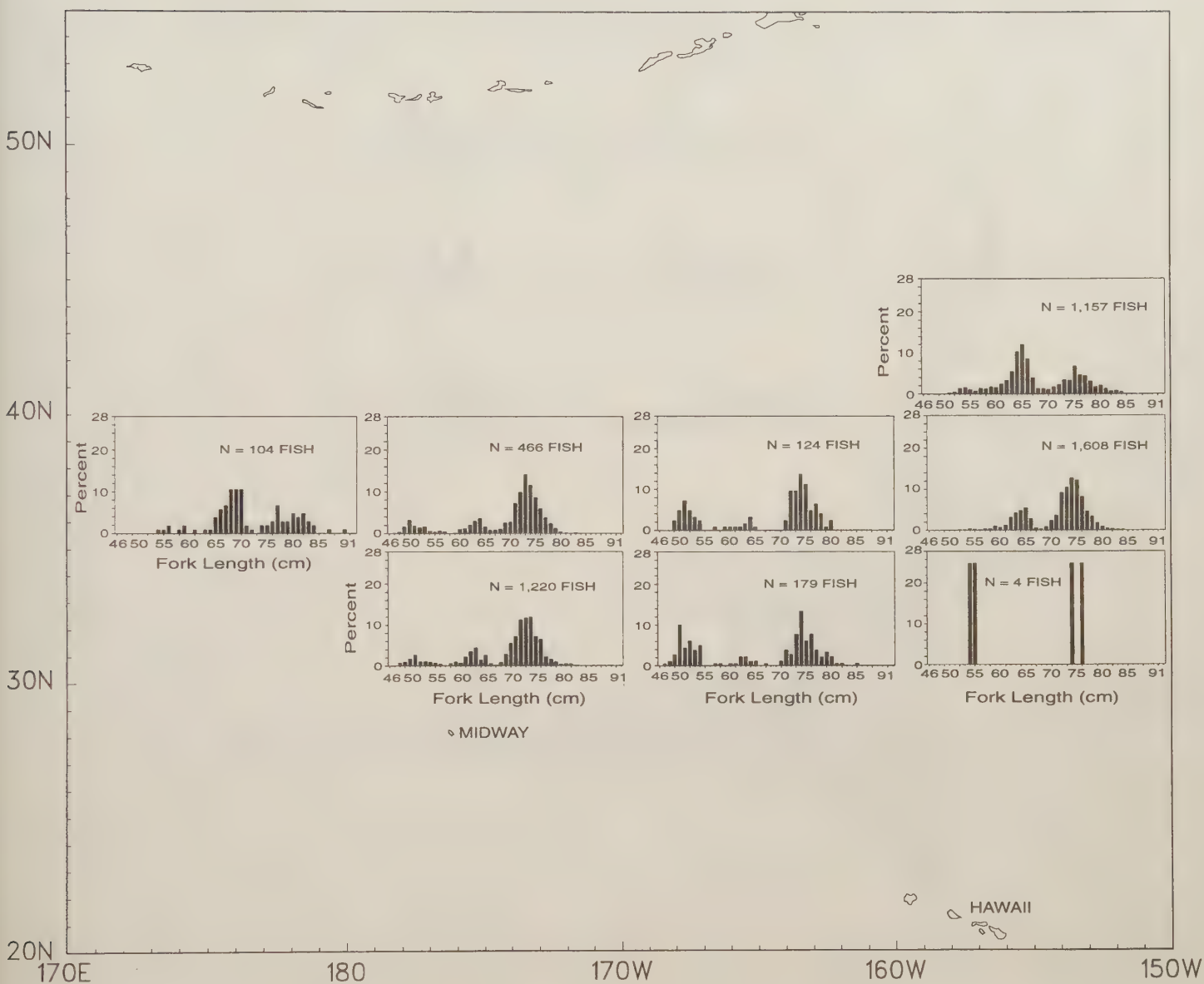


Figure 6. Size distribution of albacore sampled from the 1993 U.S. north Pacific troll fishery summarized by 5° x 10° quadrangles.

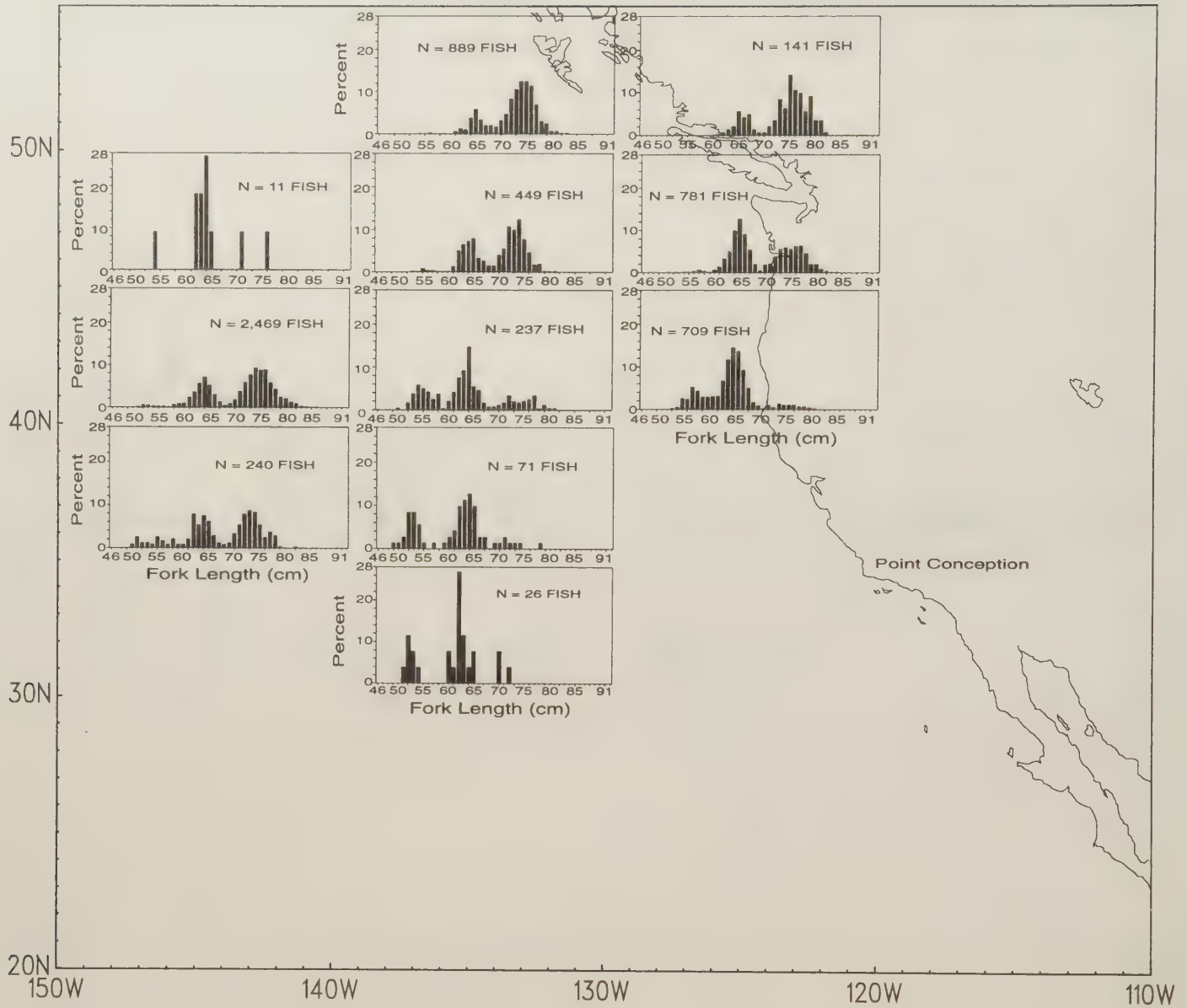


Figure 6. Continued.

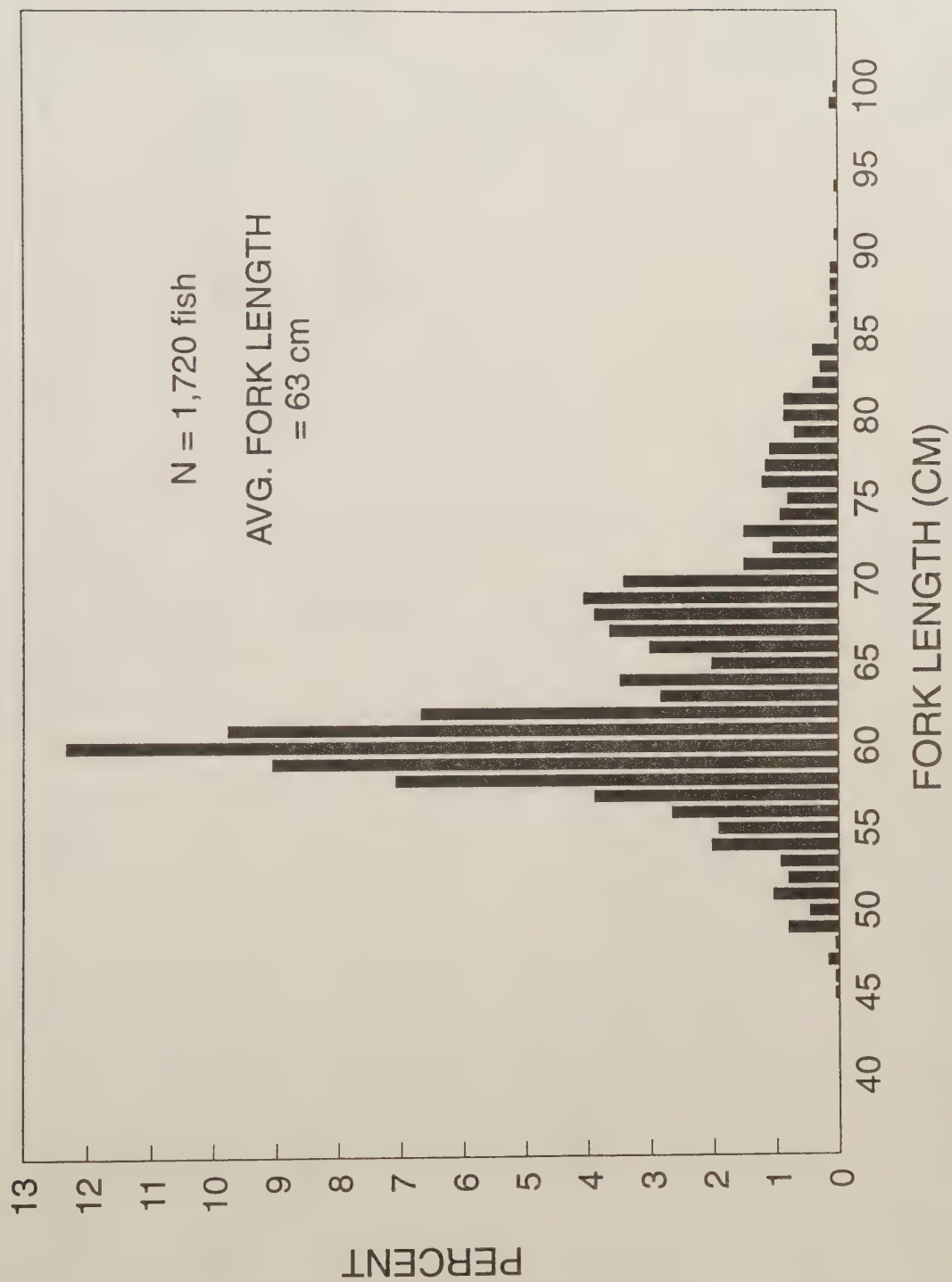


Figure 7. Length-frequencies of sampled albacore from the 1992-93 U.S. south Pacific troll fishery.

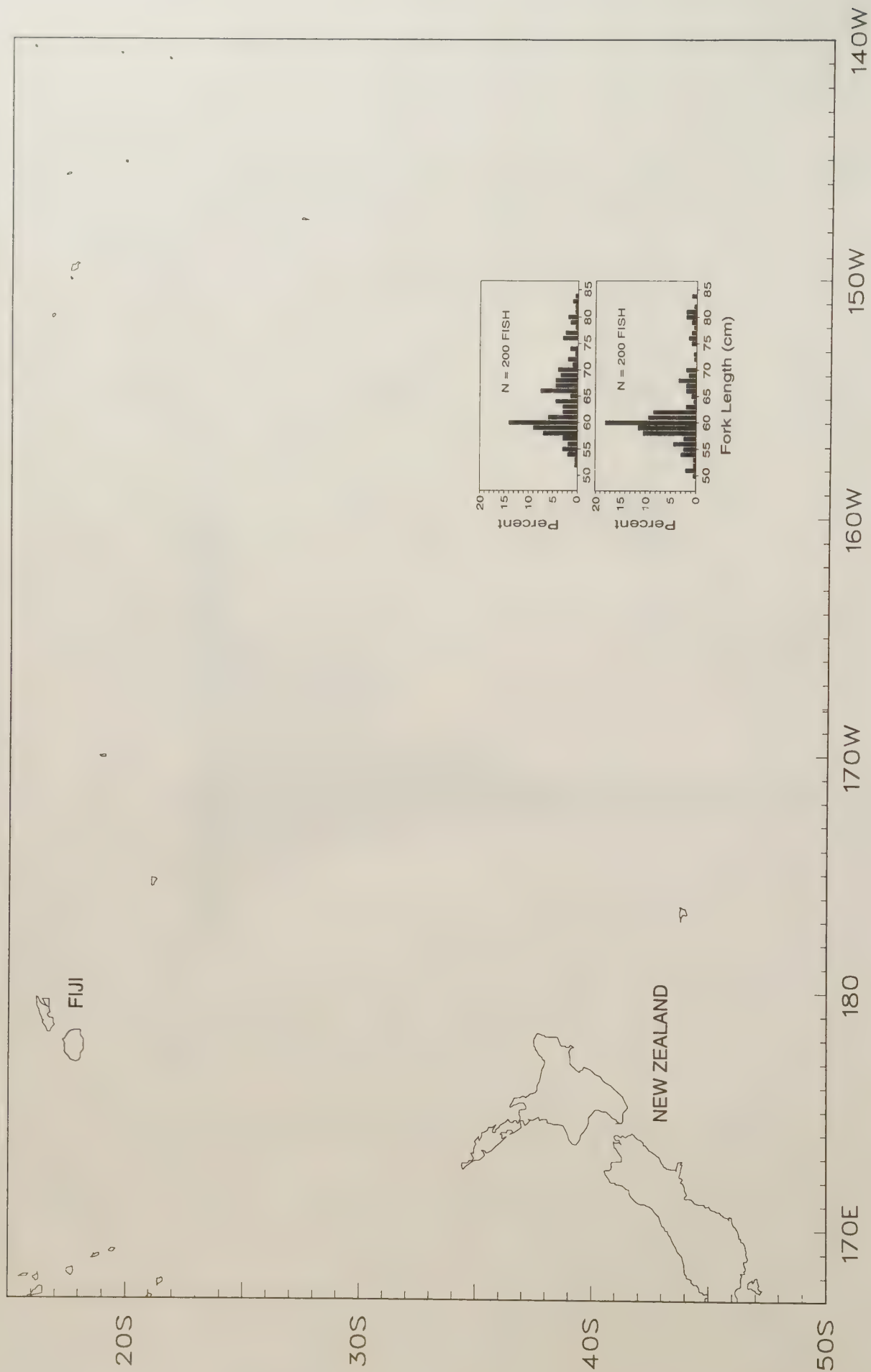


Figure 8. Size distribution of albacore sampled from the 1992-93 U.S. south Pacific troll fishery summarized by 5° x 10° quadrangles.

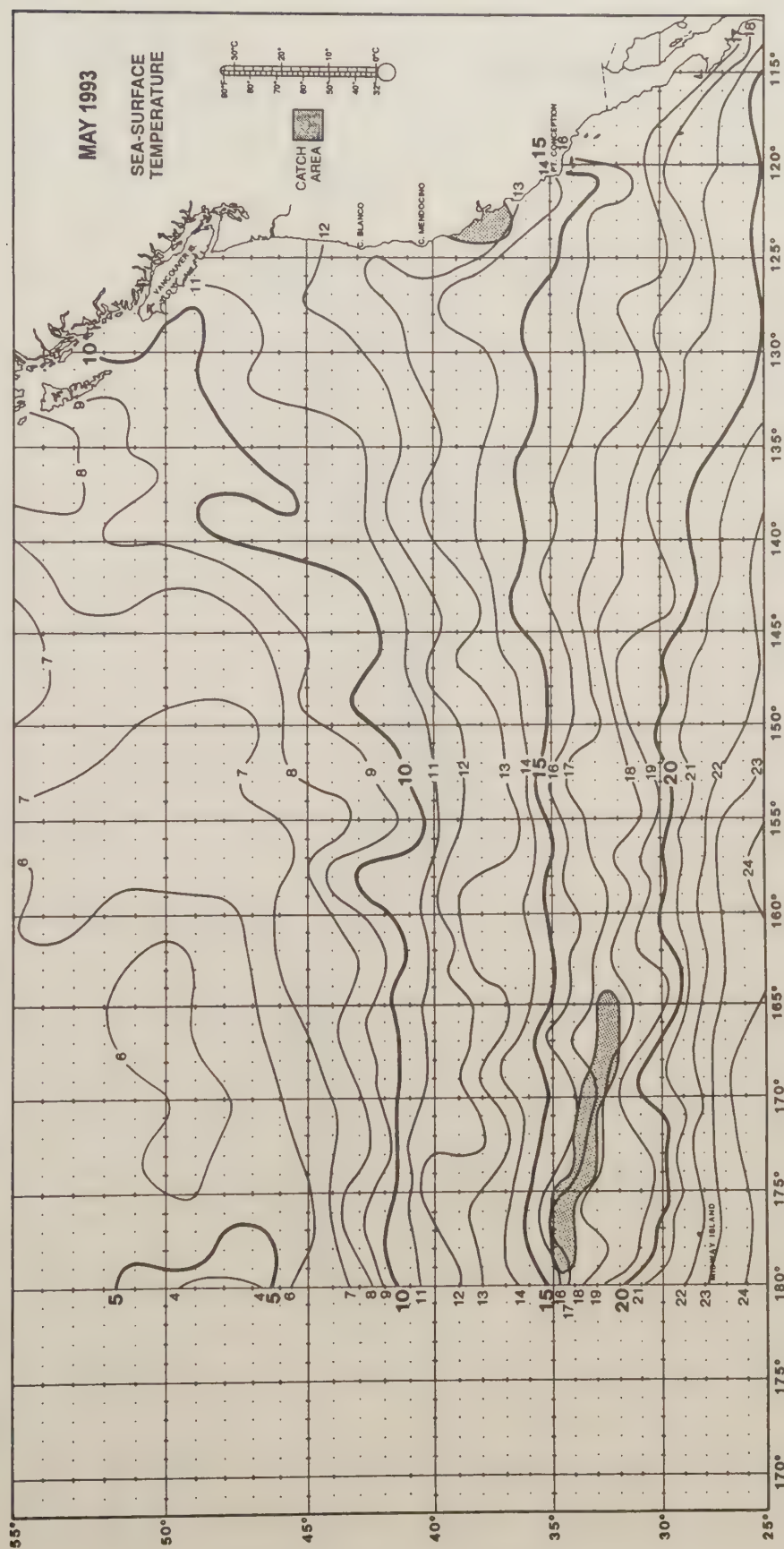


Figure 9a. Average sea surface temperature isotherms and general catch area of the U.S. north Pacific albacore troll fleet for May, 1993.

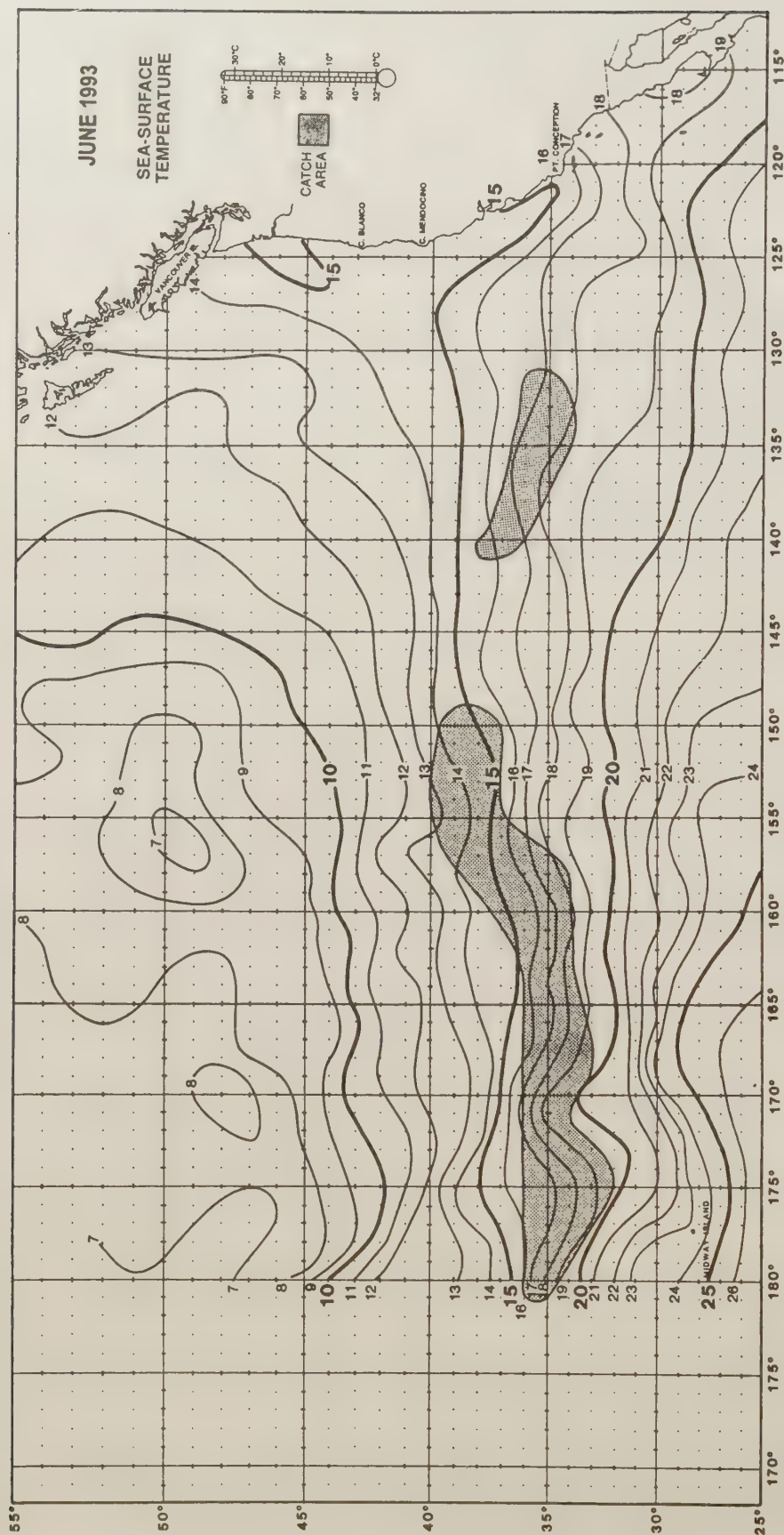


Figure 9b. Average sea surface temperature isotherms and general catch area of the U.S. north Pacific albacore troll fleet for June, 1993.

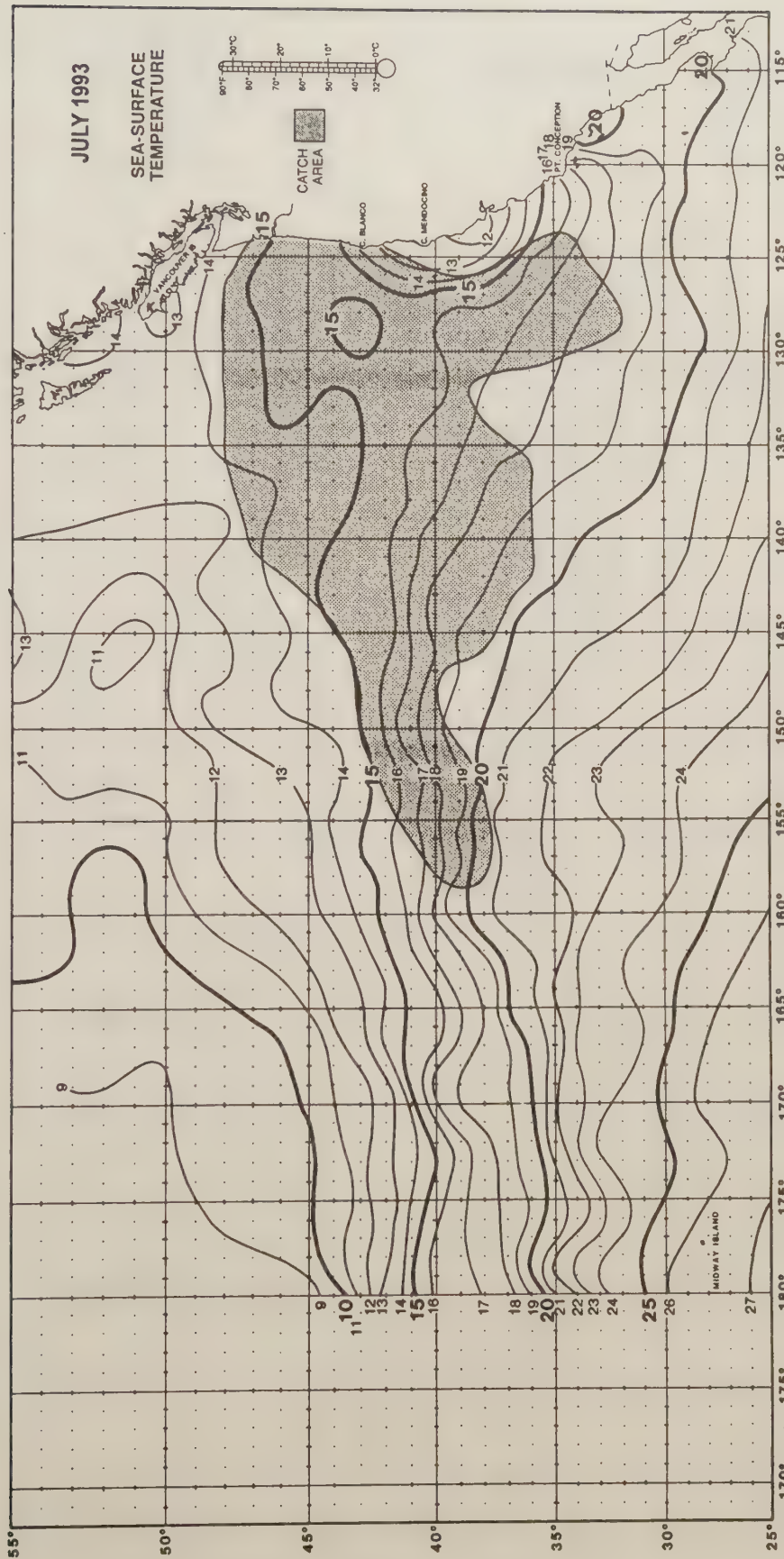


Figure 9c. Average sea surface temperature isotherms and general catch area of the U.S. north Pacific albacore troll fleet for July, 1993.

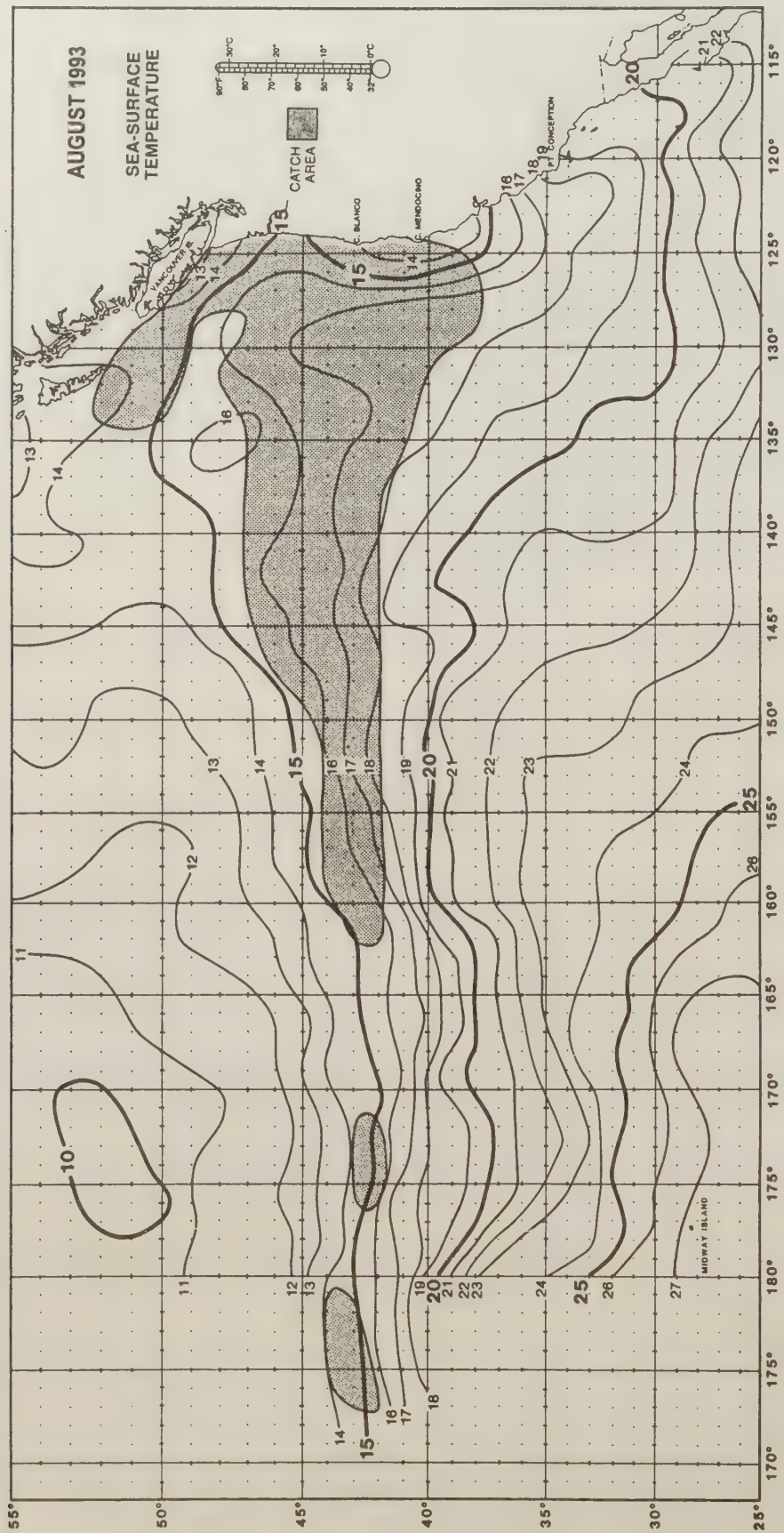


Figure 9d. Average sea surface temperature isotherms and general catch area of the U.S. north Pacific albacore troll fleet for August, 1993.

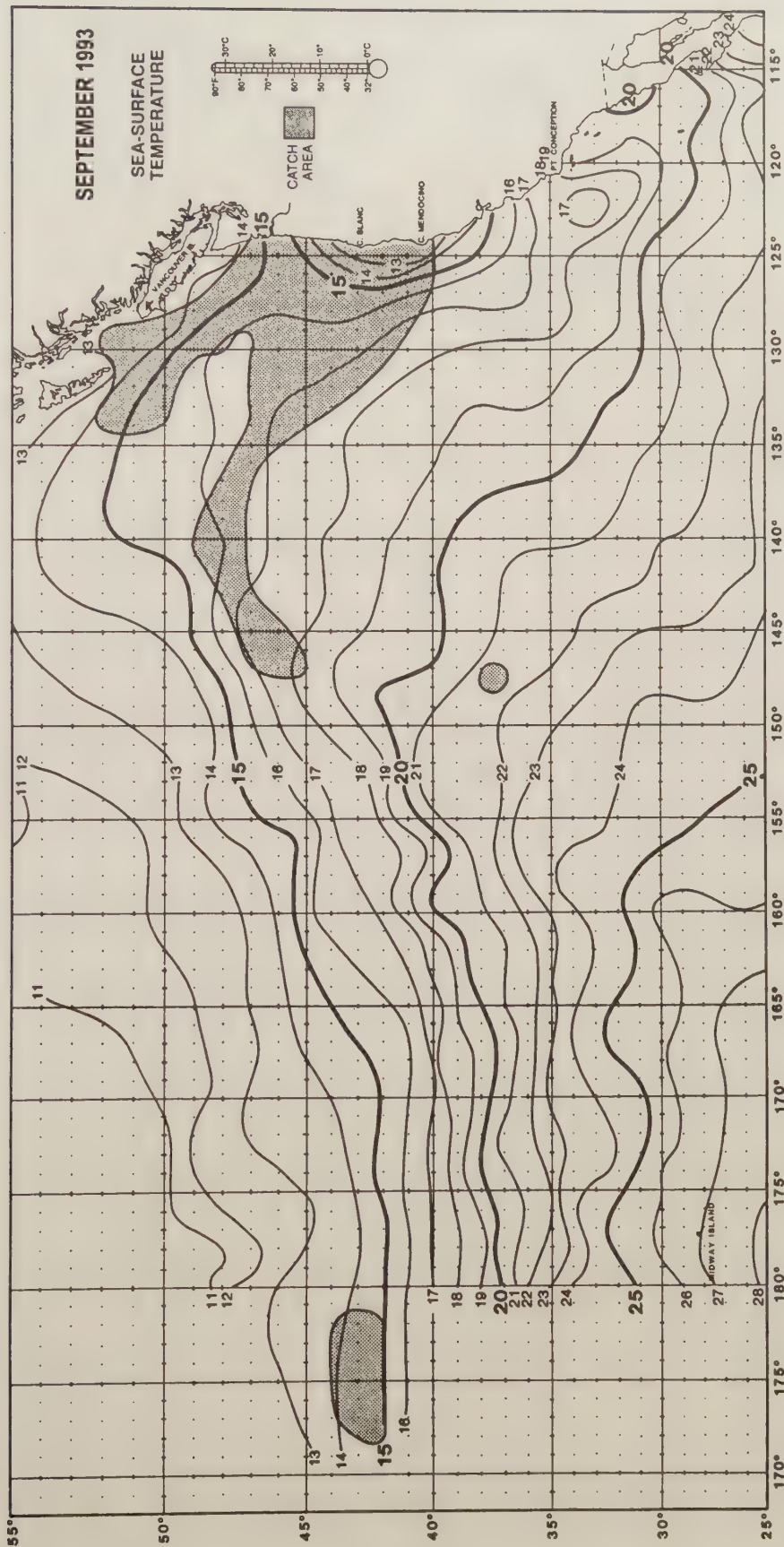


Figure 9e. Average sea surface temperature isotherms and general catch area of the U.S. north Pacific albacore troll fleet for September, 1993.

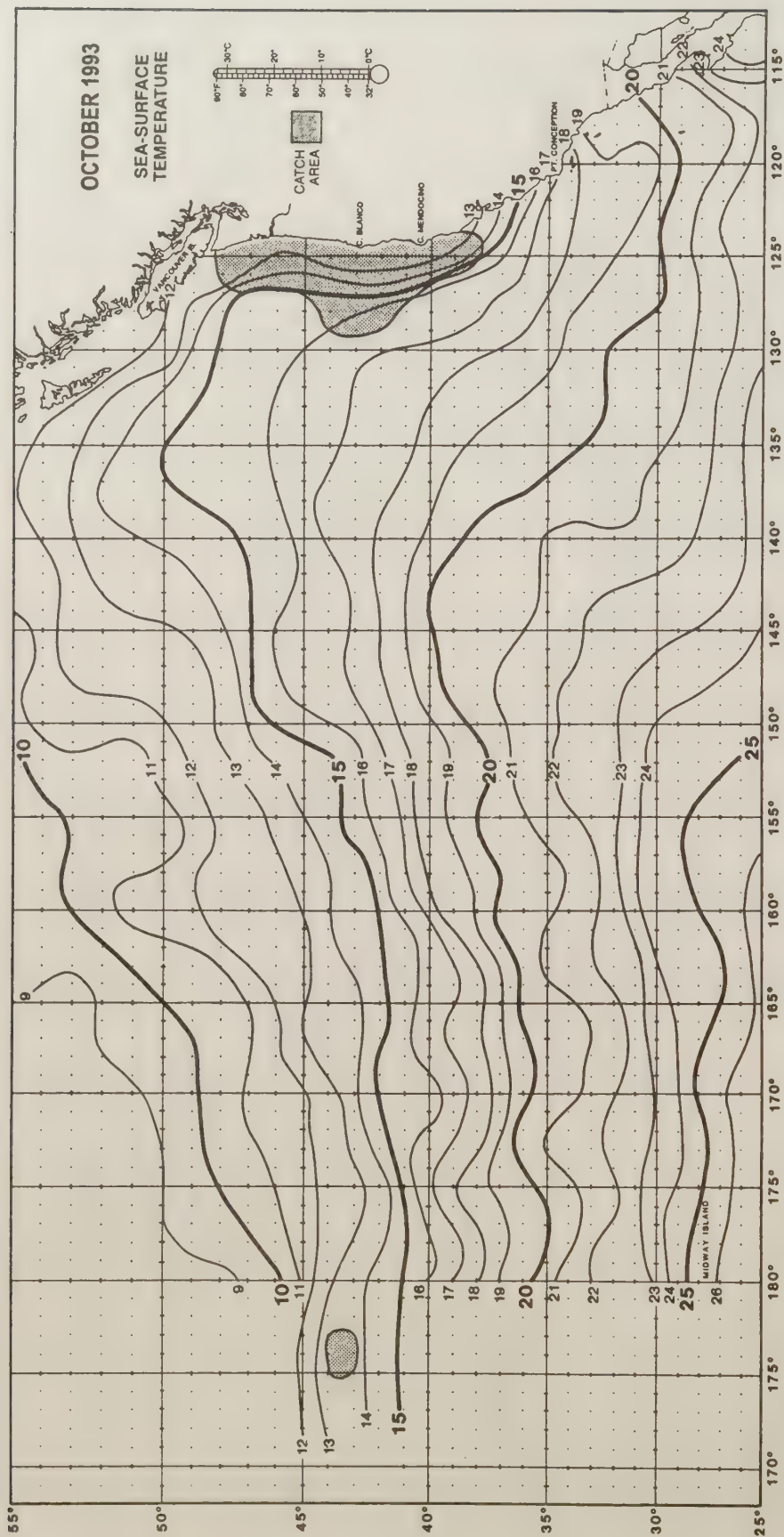


Figure 9f. Average sea surface temperature isotherms and general catch area of the U.S. north Pacific albacore troll fleet for October, 1993.

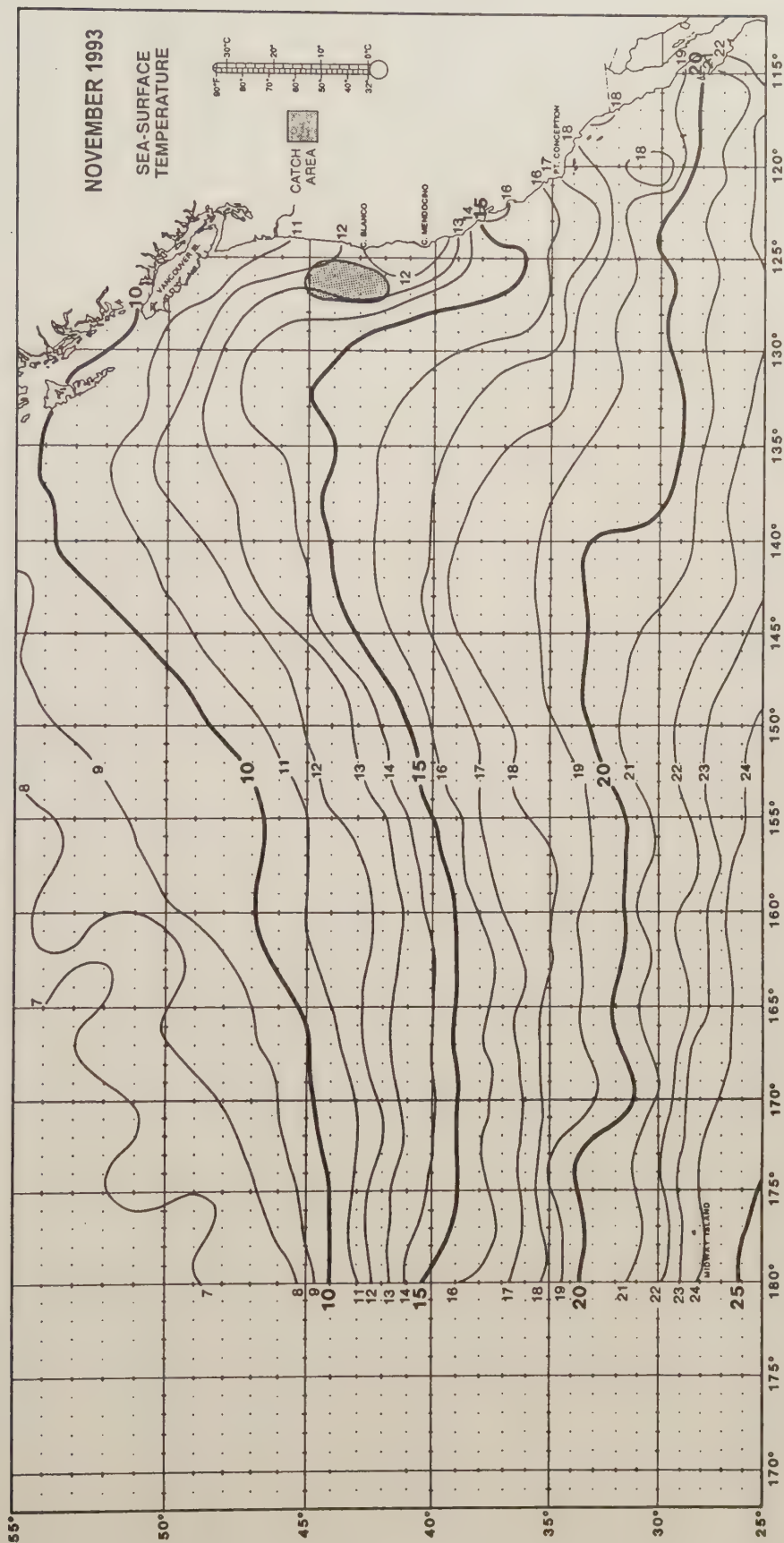


Figure 9g. Average sea surface temperature isotherms and general catch area of the U.S. north Pacific albacore troll fleet for November, 1993.

